PROJECT MANUAL

STAUNTON J&DR COURTS FACILITY

CITY OF STAUNTON, VIRGINIA

STAUNTON CITY BID REQUEST NO.: C00124

ARCHITECT'S PROJECT NO.: 630874

MOSELEYARCHITECTS

ARCHITECT/ENGINEER — RICHMOND, VIRGINIA

TIMMONS GROUP

CIVIL ENGINEERING — RICHMOND, VIRGINIA

SHEN MILSOM & WILKE

AUDIOVISUAL AND INFORMATION TECHNOLOGY — ARLINGTON, VIRGINIA

BID SET

March 1, 2024

TABLE OF CONTENTS

DIVISION 00 PROCUREMENT AND CONTRACTING REQUIREMENTS

Invitation to Bid
Instructions to Bidders (AIA Document A701)
000101 Supplemental Instructions to Bidders
Prebid Question Form
Bid Form
Bid Bond
000515 City of Staunton / VPPA Project Requirements
000516 Employment Verification Act
Standard Form of Agreement Between Owner and Contractor (AIA Document A101)
Performance Bond
Payment Bond
General Conditions of the Contract for Construction (AIA Document A201)
000750 Supplementary General Conditions

SPECIFICATIONS

DIVISION 1 – GENERAL REQUIREMENTS

010200 General Sitework Requirements
011000 Summary
012000 Price and Payment Procedures
012100 Allowances
012200 Unit Prices
012500 Substitution Procedures
Substitution Request Form (After Receipt of Bids)
013000 Administrative Requirements
013216 Construction Progress Schedule
014000 Quality Requirements
014200 Definitions and Reference Standards
014520 Testing, Adjusting, and Balancing for HVAC
015000 Temporary Facilities and Controls
016000 Product Requirements
017000 Execution and Closeout Requirements
017419 Construction Waste Management and Disposal
017800 Closeout Submittals
017900 Demonstration and Training
018119 Indoor Air Quality Requirements
018317 Exterior Building Enclosure Air Barrier Requirements

DIVISION 2 – EXISTING CONDITIONS

024100 Demolition
024113 Selective Site Demolition

DIVISION 3 – CONCRETE

033000 Cast-In-Place Concrete
034500 Precast Architectural Concrete

DIVISION 4 – MASONRY

042000 Unit Masonry

DIVISION 5 – METALS

051200 Structural Steel Framing
052100 Steel Joist Framing
053100 Steel Decking
054000 Cold-Formed Steel Framing – Structural (CFSF-S)
054003 Continuous Insulation (CI) Framing System, Clipped
055000 Metal Fabrications
055100 Metal Stairs
055133 Metal Ladders
055213 Pipe and Tube Railings
057000 Decorative Metal Railing

DIVISION 6 – WOOD PLASTICS AND COMPOSITES

061000 Rough Carpentry
064100 Architectural Woodwork and Casework
064400 Custom Courts Woodwork and Casework

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

071300 Sheet Waterproofing
072100 Thermal Insulation
072736 Sprayed Foam (SPF) Air Barrier
074213.23 Metal Composite Material Wall Panels
075423 TPO Membrane Roofing
076200 Sheet Metal Flashing and Trim
077100 Roof Specialties
077200 Roof Accessories
078400 Firestopping
078426 Thermal Barriers for Plastics
079200 Joint Sealants

DIVISION 8 – OPENINGS

081113 Steel Doors and Frames
081416 Flush Wood Doors
081433 Stile and Rail Wood Doors
083100 Access Doors and Panels
083323 Overhead Coiling Doors
084313 Aluminum-Framed Storefronts
084413 Glazed Aluminum Curtain Walls
085619 Pass Windows
085653 Security Windows
087100 Door Hardware
087113 Power Door Operators
088000 Glazing
088813 Fire-Rated Glazing
089100 Louvers

DIVISION 9 – FINISHES

092216	Cold Formed Steel Framing - Non-Structural (CFSF-NS)
092900	Gypsum Board
093000	Tiling
095100	Acoustical Ceilings
095753	Security Ceiling Assemblies
096513	Resilient Base and Accessories
096519	Resilient Tile Flooring
096623	Resinous Matrix Terrazzo Flooring
096813	Tile Carpeting
097200	Wall Coverings
098414	Acoustic Stretched-Fabric Wall and Ceiling Systems
099100	Painting

DIVISION 10 – SPECIALTIES

101400	Signage
102113.17	Phenolic Toilet Compartments
102600	Wall and Door Protection
102800	Toilet and Bath Accessories
104400	Fire Protection Specialties
107300	Protective Covers
107500	Flagpoles

DIVISION 11 – EQUIPMENT

111400	Pedestrian Control Equipment
111900	Detention Equipment
111910	Custom / Security Hollow Metal Work
111950	Security Glass and Glazing
111960	Security Hardware

DIVISION 12 – FURNISHINGS

122400	Window Shades
126723	Courtroom Bench Seating

DIVISION 13 – SPECIAL CONSTRUCTION (not used)

DIVISION 14 – CONVEYING SYSTEMS

142400	Hydraulic Elevators

DIVISION 21 – FIRE SUPPRESSION

210500	Common Work Results for Fire-Suppression
211000	Water-Based Fire-Suppression Systems

DIVISION 22 – PLUMBING

220500	Common Work Results for Plumbing Piping
220513	Motors for Plumbing Equipment
220516	Expansion Fittings and Loops for Plumbing Piping
220517	Sleeves and Sleeve Seals for Plumbing Piping
220519	Meters and Gages for Plumbing Piping
220523	General-Duty Valves for Plumbing Piping

220529 Hangers and Supports for Plumbing Piping and Equipment
220553 Identification for Plumbing Piping and Equipment
220700 Plumbing Insulation
221113 Facility Natural Gas Piping
221116 Domestic Water Piping
221119 Domestic Water Piping Specialties
221125 Circulating Pumps
221316 Sanitary Waste and Vent Piping
221319 Sanitary Waste Piping Specialties
221413 Facility Storm Drainage Piping
221423 Storm Drainage Piping Specialties
221429 Sump Pumps
223400 Fuel-Fired Domestic Water Heaters
224000 Plumbing Fixtures
224500 Emergency Plumbing Fixtures
224600 Security Plumbing Fixtures

DIVISION 23 – MECHANICAL

230500 Common Work Results for HVAC
230513 Motors for HVAC Equipment
230514 Variable Speed Drives
230516 Expansion Fittings and Loops for HVAC Piping
230517 Sleeves and Sleeve Seals for HVAC Piping
230519 Meters and Gages for HVAC Piping
230523 General-Duty Valves for HVAC Piping
230529 Hangers and Supports for HVAC Piping and Equipment
230548 Vibration Control for HVAC
230553 Identification for HVAC Piping and Equipment
230700 HVAC Insulation
230900 Building Automation System
230993 Sequence of Operations for HVAC Controls
232113 Hydronic Piping
232123 Hydronic Pumps
232300 Refrigerant Piping
233113 Metal Ducts
233300 Air Duct Accessories
233423 HVAC Power Ventilators
233600 Air Terminal Units
233713 Diffusers, Registers, and Grilles
234100 Particulate Air Filtration
235100 Breechings, Chimneys, and Stacks
235216 Condensing Boilers
237413 Packaged Outdoor Central Station Air Handling Units
238126 Ductless Mini-Split Air Conditioning Units
238239 Unit Heaters

DIVISION 25 – INTEGRATED AUTOMATION (not used)

DIVISION 26 – ELECTRICAL

260519	Low-Voltage Electrical Power Conductors and Cables
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533	Raceways and Boxes for Electrical Systems
260543	Underground Ducts and Raceways for Electrical Systems
260544	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
260553	Identification for Electrical Systems
260572	Overcurrent Protective Device Short-Circuit Study
260573	Overcurrent Protective Device Coordination Study
260574	Overcurrent Protective Device Arc-Flash Study
260923	Lighting Control Devices
260943	Relay-Based Lighting Controls
262200	Low-Voltage Transformers
262413	Switchboards
262416	Panelboards
262714	Utility Service Entrance (DVP)
262726	Wiring Devices
262813	Fuses
262816	Enclosed Switches and Circuit Breakers
262913	Enclosed Controllers
263213	Engine Generators
263600	Transfer Switches
264113	Lightning Protection for Structures
264313	Surge Protection for Low-Voltage Electrical Power Circuits
265119	LED Interior Lighting
265613	Lighting pole and standards
265619	LED Exterior Lighting

DIVISION 27 – COMMUNICATIONS

270500	Common Work Results for Communications
270528	Pathways for Communications Systems
271100	Communications Equipment Room Fittings
271300	Communications Backbone Cabling
271500	Communications Horizontal Cabling
275227	Elevator 2-way Intercom System
276410	RF BDA-Based Signal Booster System

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

280500	Common Work Results for Electronic Safety and Security
283111	Digital, Addressable Fire-Alarm System
285000	Security Control System
285010	PLC, Network, and UPS Systems
285020	Video Graphical User Interface
285030	Cabinets and Enclosures
285100	Audio Communication Systems
285200	Video Surveillance
285220	Interview Room Recording System

285260 Video Management System
285300 Access Control System
285400 Duress – Misc. Systems
285500 Auxiliary Control Systems
285900 Security Management Server

DIVISION 31 – EARTHWORK
312000 Earth Moving

DIVISION 32 – EXTERIOR IMPROVEMENTS
321216 Asphalt Paving
321313 Site Concrete
321700 Pavement Markings, Signs, and Specialties
323114 Security Chain-Link Fences and Gates
329200 Lawns & Grasses
329300 Exterior Plants

DIVISION 33 – UTILITIES
331000 Exterior Water System
333000 Sanitary Sewerage
334100 Storm Utility Drainage Piping
334200 Foundation Drainage Systems

DIVISION 34 – TRANSPORTATION (not used)

END OF TABLE OF CONTENTS

INVITATION TO BID

Bid Request No. C00124

Sealed bids for construction of the **Staunton J&DR Courts Facility**, will be received in person, via regular mail by U.S. Postal Service, or via special courier service at the City of Staunton; **116 West Beverley St; Staunton, VA, 24401; 3rd Floor Finance Department, ATTN Chad Horvat**, until but no later than **2:00 P.M.**, local prevailing time, **March 29, 2024**, and then publicly opened and read immediately thereafter.

Bids received after the announced time and date for submittal, whether by mail or otherwise, will be rejected. Bidders are responsible for ensuring their Bid is received before the deadline indicated. Bids submitted by telephone, text message, email, or facsimile shall not be accepted.

The Work generally consists of demolition of a retail store building and construction of a new courts facility, including courtrooms, office and customer service spaces, and secure holding areas. The construction shall include all required site and utility work as indicated in the Contract Documents.

A **non-mandatory** pre-bid conference will be held at **8:30 A.M.**, on **March 15, 2024**, at **116 West Beverley St; Staunton, VA; 24401; 1st Floor Caucus Room**. Pre-bid questions will not be answered at the pre-bid conference; submit questions in writing via the process below to allow for record-keeping.

On March 1, 2024, Bidders may obtain bidding documents in .pdf format from the City of Staunton website: https://www.ci.staunton.va.us/departments/finance/procurement and at the Virginia State Procurement site (eVA): https://mvendor.cgieva.com/Vendor/public/AllOpportunities

Refer to the Instructions to Bidders and Supplemental Instructions to Bidders for bidding procedures and requirements.

Any questions relating to the Bidding Documents shall be directed to Katelyn Garay, Moseley Architects at kgaray@moseleyarchitects.com . Questions shall be submitted on Prebid Question Form included in the Bidding Documents.

All questions are due by March 18, 2024 at 5pm.

END OF INVITATION TO BID

AIA® Document A701® – 2018

Instructions to Bidders

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

City of Staunton – Juvenile and Domestic Relations Courthouse
Staunton, Virginia

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

City of Staunton, Virginia
116 West Beverley Street
Staunton, Virginia 24401
Telephone Number: 540-332-3812

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

Moseley Architects P.C.
3200 Norfolk Street
Richmond, Virginia 23230
Telephone Number: 804-794-7555

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.

AIA Document A701 – 2018. Copyright © 1970, 1974, 1978, 1987, 1997 and 2018. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:52:44 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1181764962)

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, but are subject to and governed by definitions under applicable laws and regulations.

§ 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 in conformance with 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.

§ 1.10 A Responsible Bidder means a person or entity that has the capability, in all respects, to perform fully the Contract requirements and the moral and business integrity and reliability that will assure good faith performance.

§ 1.11 A Responsive Bidder means a person or entity that has submitted a Bid which conforms in all material respects to the Invitation to Bid and requirements of the Bidding Documents.

§ 1.12 An informality means a minor defect or variation of a Bid from the exact requirements of the Invitation to Bid and of the Bidding Documents which does not affect the price, quality, quantity or delivery schedule for the goods, services or construction being procured.

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.

AIA Document A701 – 2018. Copyright © 1970, 1974, 1978, 1987, 1997 and 2018. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:52:44 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1181764962)

.7 The Bidder has carefully reviewed the Bidding Documents and has verified that all of the Bidding Documents received are complete. The Bidder shall notify the Architect immediately if received Bidding Documents are not complete.

.8 The Bidder has familiarized itself with all applicable federal, state and local laws, ordinances, rules and regulations that in any manner may affect cost, progress or performance of the Work; the Bidder has obtained the necessary licenses for bidding, if applicable, and is licensed or certified to perform the Work.

.9 The Bidder shall pay all county, city, state and federal taxes required by laws in effect at the time the Bids are received and resulting from the Work or traceable thereto. Said taxes shall not be in addition to the Contract price between the Owner and the Bidder, as the taxes shall be an obligation of the Bidder and not of the Owner, and the Owner shall be held harmless and indemnified for the same by the Bidder.

.10 The failure or omission of any Bidder to receive or examine any form, instrument, addendum or other documents, or to acquaint itself with conditions existing at the site(s), shall in no way relieve any Bidder from any obligations with respect to its Bid or to the Contract.

.11 The Bidder agrees that its Bid shall be based on products and work indicated in the Bidding Documents.

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.)

§ 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.)

§ 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.

AIA Document A701 – 2018. Copyright © 1970, 1974, 1978, 1987, 1997 and 2018. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:52:44 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1181764962)

§ 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.

§ 3.3.1.1 The Bidder assumes all risks using a price or bid proposal representing a product or Work that is not indicated in the Bidding Documents and, if the Bidder elects to use that product or Work he shall submit it in accordance with the Division 1 requirements, and as stated herein. If that product or Work is rejected, the Bidder shall provide a product or Work indicated in the Bidding Documents at its cost. The Architect and the Owner shall not consider any requests for additional payments to provide the Work as required by the Contract Documents.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten 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 provided in the Bidding Documents.

(Paragraph deleted)

§ 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.

§ 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.)

Copies of the Addendum will be posted electronically.

§ 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.

§ 3.4.3.1 Depending on the nature of an Addendum (clarifications, limited scope of revisions, added manufacturers) issued less than four days prior to receipt date, the Architect, in its professional judgment, reserves the right to issue said Addendum without postponement of the bid date. However, if in the professional judgment of the Architect, the information contained in the Addendum would be such that it would be unfair or unreasonable to prepare a bid proposal based on the revisions in the Addendum, then the bid date will be postponed to allow distribution of the Addendum and time to prepare a bid proposal.

§ 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 Where so indicated by the bid form, all amounts shall be expressed in figures only.

AIA Document A701 – 2018. Copyright © 1970, 1974, 1978, 1987, 1997 and 2018. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:52:44 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1181764962)

§ 4.1.4 All changes made by the Bidder to the bid form or outside of the envelope shall be signed or initialed by the Bidder. Bids containing any conditions, omissions, erasures, alterations, or items not called for in the Bid, may be rejected by the Owner as being incomplete or nonresponsive.

§ 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 bid security in the form of either a cashier's or certified check or an acceptable Bid Bond in the amount of five percent (5%) of the Bid amount, and made payable to the City of Staunton. The bid security is a guarantee that if the Contract is awarded by the Owner to the Bidder, the Bidder shall enter into the Contract with the Owner for the Work mentioned in this Bid or forfeit the bid security to the Owner, not as a penalty, but as liquidated damages. No forfeiture under a bid security shall exceed the lesser of (i) the difference between the Bid for which the bid security was written and the next low Bid of another Bidder, or (ii) the face amount of the bid security. *(Insert the form and amount of bid security.)*

§ 4.2.2 All bonds shall be executed by a surety company selected by the Bidder which is legally authorized to do business in the Commonwealth of Virginia, and the bond shall be the same in both form as well as substance as AIA Document A310, Bid Bond. The Bidder shall require the attorney-in-fact, who executed the required bond on behalf of the surety company, to affix thereto a certified and current copy of the power of attorney. The bond premium shall be paid by the Bidder and the cost shall be included in the 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.

§ 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, beginning days 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.)

AIA Document A701 – 2018. Copyright © 1970, 1974, 1978, 1987, 1997 and 2018. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:52:44 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1181764962)

§ 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.

§ 4.3.2.1 The Bidder shall place on the outside of the envelope containing its Bid the following notation: "Contractor License Number _____ and Class of License."

§ 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.

§ 4.3.6 In the solicitation or awarding of Contracts, the Owner shall not discriminate because of the race, religion, color, sex, age, disability or national origin of the Bidder. The Owner welcomes and encourages the participation of small businesses and businesses owned by women and minorities in procurement transactions made by the Owner.

§ 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.)

§ 4.4.3.1 The Bidder shall submit to the Owner its original work papers, documents and materials used in the preparation of the Bid within one (1) day after the date fixed for submission of Bids. Such work papers shall be delivered to the Owner by the Bidder in person or by registered mail at or prior to the time fixed by the Owner for the opening of Bids. The Contract shall not be awarded by the Owner until such period has elapsed. Such mistake shall be proved only from the original work papers, documents, and materials delivered to the Owner as required herein.

§ 4.4.3.2 No Bidder who is permitted to withdraw a Bid shall for compensation, supply any material or labor to or perform any subcontract or other work agreement for the person or firm to whom the Contract is awarded or otherwise benefit directly or indirectly from the performance of the Work for which the withdrawn Bid was submitted.

§ 4.4.3.3 If a Bid is withdrawn under authority of this section, the next lowest responsive and responsible Bidder shall be deemed to be the low Bidder.

AIA Document A701 – 2018. Copyright © 1970, 1974, 1978, 1987, 1997 and 2018. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:52:44 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1181764962)

§ 4.4.3.4 When the procedure set forth in the paragraphs above is utilized, original work papers, documents, and materials used in the preparation of the Bid must be submitted in an envelope or package separate and apart from the envelope containing the Bid marked clearly as to the contents.

§ 4.4.3.5 If the Owner denies the withdrawal of a Bid under the provisions of this section, it shall notify the Bidder in writing stating the reasons for its decision and award the Contract to such Bidder at the Bid price, provided such Bidder is a responsible and responsive Bidder.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

All Bids received on time in accordance with the Bidding Document requirements shall be opened and publicly read aloud. Any Bidder, upon request, shall be afforded the opportunity to inspect Bid records within a reasonable time after the opening of all Bids but prior to award, except in the event that the public body decides not to accept any of the Bids and to reopen the Contract. Otherwise, Bid records shall be open to public inspection only after award of the Contract. Any inspection of procurement transaction records shall be subject to reasonable restriction to ensure the security and integrity of the records.

§ 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 and does not exceed the funds available. 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 own best interests.

§ 5.3.1.1 In determining the lowest responsible Bidder, the Owner may consider, among other things, the Bidder's past performance, conduct on other contracts, and other information provided by the Bidder, including in the Contractor's Pre-Qualification Package, if requested.

§ 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.

§ 5.3.3 In case of a tie Bid, preference may be given to goods, services, and construction produced in the Commonwealth of Virginia or provided by persons, firms or corporations having principal places of business in the Commonwealth of Virgina, if such a choice is available; otherwise the tie shall be decided by lot.

§ 5.3.4 If a Contract is to be awarded, the Owner will give the Bidder a Notice of Award within sixty (60) calendar days after the day of the Bid opening.

§ 5.4 NEGOTIATION WITH LOWEST RESPONSIVE AND RESPONSIBLE BIDDER

§ 5.4.1 If award of a Contract to the lowest responsive and responsible Bidder is precluded because of limitations on available funds, the Owner reserves the right to negotiate the Bid amount with the lowest responsive, responsible Bidder to obtain a Contract amount within the available funds. The negotiations may involve changes in either the features or scope of the Work. Such negotiations may include reducing the quantity, quality, or other cost saving mechanisms involving items in the Bid amount, including unit prices (if any) and/or allowances (if any) that affect the Bid amount, and/or Alternates (if any).

§ 5.4.2 The Owner shall notify the lowest responsive and responsible Bidder that such a situation exists and the Owner and Bidder shall then conduct their negotiations in person, by mail, by telephone or by any means they find convenient.

§ 5.4.3 If an acceptable Contract can be negotiated, the changes to the Bid amount and Bidding Documents agreed upon in the negotiations shall be summarized in a "Post Bid Addendum," and included in the Contract.

AIA Document A701 – 2018. Copyright © 1970, 1974, 1978, 1987, 1997 and 2018. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:52:44 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1181764962)

§ 5.4.4 If the Owner and the lowest responsive and responsible Bidder cannot negotiate a Contract within available funds, the Owner shall terminate negotiations and reject all bids.

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 in writing if either the Owner, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution, provided such adjustment in cost is justifiable and reasonable. The Owner may accept the adjusted bid price or disqualify the Bidder. 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 has 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.

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.

§ 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.)

AIA Document A701 – 2018. Copyright © 1970, 1974, 1978, 1987, 1997 and 2018. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:52:44 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1181764962)

§ 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 (Agreement).

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

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

§ 8.1 Unless otherwise required in the Bidding Documents, the Contract for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and

(Paragraphs deleted)

Contractor Where the Basis of Payment Is a Stipulated Sum.

(Paragraphs deleted)

§ 8.2 The Contractor recognize that time is of the essence and that the Owner will suffer financial loss if the Work is not completed by the Substantial Completion date required or as may be amended by the Contract Documents. Contractor recognizes the delays, expenses and damages that are involved in proving in a legal proceeding the actual loss that may be suffered by the Owner if the Work is not completed on time. Accordingly, the Owner and the Contractor agree, stipulate and fix as liquidated damages if delayed, but not as a penalty, the sum indicated on the Bid Form that the Contractor together with the Contractor's surety shall pay the Owner for each calendar day or part thereof that expires after the date required or as may be amended by the Contract Documents for the Substantial Completion of the Work.

(Table deleted)
(Paragraphs deleted)
(Table deleted)

*(Paragraphs deleted)***§ 8.3** The Contractor recognizes that time is of the essence and that the Owner will suffer financial loss if the Work is not completed by the Final Completion date required or as may be amended by the Contract Documents. The Contractor recognizes the delays, expenses and damages that are involved in proving in a legal proceeding the actual loss that may be suffered by the Owner if the Work is not completed on time. Accordingly, the Owner and the Contractor agree, stipulate and fix as liquidated damages if delayed, but not as a penalty, the sum indicated on the Bid Form that the Contractor together with the Contractor's surety shall pay the Owner for each calendar day or part thereof that expires after the date required or as may be amended by the Contract Documents for the Final Completion of the Work.

AIA Document A701 – 2018. Copyright © 1970, 1974, 1978, 1987, 1997 and 2018. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:52:44 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1181764962)

SECTION 000101 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

Section 000101, Supplementary Instructions to Bidders, contains modifications to the basic document, **AIA Document A701, Instructions to Bidders, 2018 Edition**, in the form of additions, deletions and substitutions. Where any part of the basic document is so modified by these Supplementary Instructions, the unaltered provisions shall remain in effect. These Supplementary Instructions constitute part of the Bidding Requirements.

AIA Document A701, as modified herein, constitutes an invitation to bid on the Project pursuant to the provisions of Section 2.2-4302.1 of the Code of Virginia, and the other provisions of the Virginia Public Procurement Act (Virginia Code 2.2-4300 *et seq.*) (the "VPPA"). This solicitation is subject to all applicable terms of the VPPA. By submitting a bid in response to this solicitation, Bidders agree to all the provisions of these Bidding Documents.

The Owner does not discriminate against faith-based organizations in accordance with the Code of Virginia, section 2.2-4343.1 or against an Offeror because of race, religion, color, sex, national origin, age, disability, sexual orientation, gender, gender identity, political affiliation, veteran status, marital status, pregnancy, childbirth or related medical conditions, or any other basis prohibited by state law relating to discrimination in employment.

ARTICLE 1 - DEFINITIONS

DELETE the last sentence of Paragraph 1.1 and SUBSTITUTE the following:

[Substitute]: The Proposed Contract Documents are the documents described as "Contract Documents" in Subparagraph 1.1.1 of Section 000750.

DELETE Paragraph 1.2 in its entirety and, in lieu thereof, SUBSTITUTE the following new Paragraph:

1.2 Except as provided for herein, all definitions set forth in the Conditions of the Contract (General, Supplementary and other conditions) or in other Contract documents are applicable to the bidding documents.

ADD the following new Subparagraph as follows:

1.2.1 The following words are intended to mean:

- Furnish (Materials): To supply and deliver to the project ready for installation and in operable condition.
- Install (Services or Labor): To place in final position, complete, anchored, connected and in operable condition.
- Provide: To furnish and install complete. When neither furnish, install nor provide is stated, provide is implied.

ADD the following to the end of Paragraph 1.4

[*Add:*] "and applicable law."

ADD the following to the end of Paragraph 1.8

[*Add:*] "and applicable law."

ARTICLE 2 – BIDDER'S REPRESENTATIONS

ADD new Paragraph 2.2 as follows:

2.2 The Bidder is required to examine carefully in detail the character of the site of the Project, the Contract Documents and all other matters pertinent to the work contemplated. By submitting a bid, the Bidder expressly represents that it has satisfied itself as to the conditions to be encountered, including conditions that are overhead, on the surface and concealed, the character, quality and quantities of work to be done and materials to be furnished, and the requirements of the Contract and Specifications. No allowance or concession will be made for the lack of such information. Where underground and overhead structure locations are shown, they are for the information of the Architect only; their correctness is not guaranteed or warranted by the Owner or the Architect, and in no event is this information to be considered a part of the Contract Documents, or to be relied upon in preparing the Bid. If this information is used by the Bidder in preparing its Bid, the Bidder must assume all risks resulting from conditions differing from those shown in the information provided. Test Boring Information concerning subsurface materials or conditions which are based upon test pits or test borings has been obtained by the Owner for the Architect's use in designing the Project. This information is available to the Bidder for information only. References to this information may be found in the Table of Contents. The technical data found in the test boring information is represented to be accurate by the Owner, but the conclusions and inferences that may be found in or inferred from the information is not warranted, and the accuracy or completeness of any such conclusions and inferences is not guaranteed by the Owner or the Architect. By submitting a bid, the Bidder represents that it has not relied upon the subsurface information supplied by the Architect or Owner and assumes all responsibility in excavating for this project for any and all subsurface conditions encountered.

The Owner will, to the extent possible, afford the Bidder the opportunity at the Bidder's own expense, to make additional borings or soundings, to drive test piles, to dig test pits on the site of the Work, and to make measurements and studies of all kinds.

There is no expressed or implied agreement that the existing conditions have been correctly indicated and bidders shall take into account that conditions affecting the cost or quantities of work to be done may differ from those indicated.

The Bidder shall carefully examine all Bidding Documents and materials pertinent thereto, with respect to all the categories of work for which the Owner has advertised and will receive bids, so that it is completely aware and satisfied as to the character, quality and quantities of all work, materials and for services required or to be provided by the Bidder to perform and complete all work of its Contract on the Project. Further, the Bidder shall have carefully examined the tentative construction schedule for the work and by submission of a bid, represents that the time set forth for such work is sufficient for the Bidder to complete its work.

The Bidder, by submission of its Bid, represents that it has visited the site, that it has read the Bidding Documents and understands their full character and intent, that it otherwise complied with the provisions of Article 3, and should the Owner subsequently accept its Bid, no claims, allowances or concessions will be made, accepted or recognized by the Owner at any future time for any additional labor, equipment or materials required, or for any difficulties encountered in the Work, or for the lack of any information which could have been foreseen, apparent or ascertained had the Bidder so complied with Article 3.

The Bidder shall ascertain all governmental and utility requirements with respect to wage scales, materials, labor, safety and sanitation and shall base its bid prices on full compliance therewith. **Specifically, this Project is subject to the Davis-Bacon Act; see Section 000515, Page 8, Item 4.**

The Bidder has familiarized itself with labor conditions which might affect or influence the performance of the Work.

ARTICLE 3 - BIDDING DOCUMENTS

Paragraph 3.1 - Copies:
Subparagraph 3.1.1

DELETE Subparagraph 3.1.1 in its entirety, and in lieu thereof, SUBSTITUTE the following new Subparagraph:

3.1.1 Bidders may obtain complete sets of Bidding Documents from City's Website there is no associated fee.

DELETE Subparagraph 3.1.2 in its entirety.

ADD new Sub-subparagraph 3.1.5.1 as follows:

3.1.5.1 The Bidder agrees that all work product produced by the Architect or its consultants are "Instruments of Service" a defined in AIA Document A201™-2007, General Conditions of the Contract for Construction. "Instruments of Service" include, without limitation, representations, in any medium of expression, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional service agreements.

The Bidder agrees that for the purposes of the bid process, the Architect is the copyright owner of such Instruments of Service and retains all common law, statutory and other reserved rights, including copyrights. Distribution of Instruments of Service to potential bidders is not to be construed as publication in derogation of the reserved rights of the Architect and the Architect's consultants.

The Architect grants to the Bidder a nonexclusive, revocable license to use the Architect's Instruments of Service solely and exclusively for purposes of developing the Bidder's bid, including securing information or bids from the Bidder's material or equipment suppliers, contractors, or subcontractors. The license granted under this section permits the Bidder or the Bidder's contractors, subcontractors, sub-

subcontractors, and suppliers to reproduce applicable portions of the Instruments of Service solely and exclusively for use in developing its bid for the Project. If the Bidder is for any reason not awarded the Contract for the Project, the license granted in this section shall immediately terminate.

The Bidder acknowledges that it shall not use the Instruments of Service for any purpose other than to prepare a bid. The Instruments of Service shall not be used as construction drawings or for any specification involved in the construction of the Project. The Bidder, for itself, and the Bidder's contractors, subcontractors, sub-subcontractors, and suppliers, hereby releases and holds the Architect and Architect's consultant(s) harmless from all claims and causes of action arising from any use of the Instruments of Service. The Bidder, to the extent permitted by law, further agrees to defend, indemnify and hold harmless the Architect and its consultants from all costs and expenses, including the cost of defense, related to claims and causes of action asserted by any third person or entity to the extent such costs and expenses arise from the Bidder's use of the Instruments of Service under this section.

Except for the licenses granted in this section, no other license or right shall be deemed granted or implied under this Agreement. The Bidder shall not assign, delegate, sublicense, pledge or otherwise transfer any license granted herein to another party without the prior written agreement of the Architect. Any unauthorized use or reproduction of the Instruments of Service shall be at the Bidder's sole risk and without liability to the Architect and the Architect's consultants, and subject to Architect's rights and remedies for infringement of Architect's rights, including without limitation, copyrights

Paragraph 3.2 – Modification or Interpretation of Bidding Documents:
Subparagraph 3.2.2

ADD the following new sentences to the end of Subparagraph 3.2.2:

3.2.2 [*Add:*] "Provided, however, that the Owner may, in its discretion, waive the provisions of the preceding sentence and reply to such a request that is not timely received. All requests for clarification or interpretation shall be made by a Prime Bidder and shall be in writing. Any request made by any other entity will not be addressed. Any request for clarification or interpretation via means other than in writing will not be addressed. Written requests will not be responded to, directly back to the Bidder. If the inquiry requires clarification to, or modification of the Contract Documents, they will be issued via Addendum. If clarification to, or modification of the Contract Documents is not required by the inquiry, the request will not be addressed. Failure to request such clarification is a waiver to any claim by the Bidder for expense made necessary by reason of later interpretation of the ITB documents by the Owner."

DELETE Subparagraph 3.3.3. in its entirety.

DELETE Subparagraph 3.3.4 in its entirety.

DELETE Subparagraph 3.3.5 in its entirety.

Paragraph 3.4 - Addenda:

ADD new Sub-subparagraph 3.4.1.1 as follows:

3.4.1.1 Clarifications to the Bidding Documents will only be made in writing, by Addenda. Oral statements may not be relied upon and will not be binding or have any legal effect.

DELETE Subparagraph 3.4.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

3.4.3 Addenda will be issued no later than two 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.

DELETE Subparagraph 3.4.4 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

3.4.4 The Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge, where indicated on the Bid Form, their receipt. Failure of the Bidder to receive any Addenda as provided for herein shall not release such bidder from the obligation of their Bid.

Paragraph 3.5 – The Contract

ADD a new paragraph 3.5 and associated subparagraphs as follows:

3.5 The Contract

3.5.1 A Bidder's submission of a bid signifies a bidder's willingness to enter into a binding legal contract with the terms contained in the Proposed Contract Documents that are part of the Bidding Documents, and at the price contained in the bid. Bidders may not vary the terms of the Proposed Contract Documents, which the Owner may alter only through Addendum, and may not take exception in their bids to the terms of the Proposed Contract Documents. Any exception to the Proposed Contract Documents may be cause for the Owner to deem a Bidder's bid non-responsive.

3.5.2 As a precondition to its acceptance of the lowest responsible bid, the Owner may, in its sole discretion, request that the Bidder withdraw or modify non responsive portions of a bid/proposal, which do not affect quality, quantity, price or delivery schedule.

ARTICLE 4 - BIDDING PROCEDURES

Paragraph 4.1 - Preparation of Bids:

ADD the following new sentences to the end of Subparagraph 4.1.1:

4.1.1 [*Add:*] "Attention is directed to the Bid Form bound in the Project Manual. This form is for the information and convenience of the Bidder and is not to be detached from the Project Manual, or filled out or executed. A separate copy of the Bid Form is furnished with the Bidding Documents. Complete two (2) separate copies of the Bid Form and

accompanying documents, execute and submit as specified in the Advertisement for Bid".

ADD the following new sentence to the end of Subparagraph 4.1.5:

4.1.5 [*Add:*] "Failure to enter an amount or "No Change", or a similar designation regarding the bid amount for a requested Alternate shall be construed to mean that no change in the Base Bid is required."

INSERT the following sentence after the second sentence of Subparagraph 4.1.7:

4.1.7 [*Insert:*] "The signature of any person, appearing on the Bid Form, shall be in longhand and in ink."

Paragraph 4.2 - Bid Security:

DELETE Subparagraph 4.2.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

4.2.3 If a Surety Bond is used for the Bid Security, it shall be written on a form similar to the enclosed Bid Bond form only, and the Attorney-in-fact who executes the Bond on behalf of the Surety, shall affix to the Bond, a certified and current copy of its power of attorney.

DELETE Subparagraph 4.2.4 in its entirety, and in lieu thereof, SUBSTITUTE the following new Subparagraph:

4.2.4 The Owner may declare the Bid Security forfeited to the Owner as liquidated damages if, following the designation, within the firm-bid period, of the Bidder as the apparently lowest responsible and responsive Bidder, such Bidder shall thereafter fail to (1) deliver to the Owner within the prescribed time the properly executed Performance Bond and Payment Bond if required by these Contract Documents or (2) if Notice of Intent to Award is given to such Bidder, deliver to the Owner, within the prescribed time, the properly executed counterparts of the construction Agreement and all evidences of insurance as required by these Contract Documents. The Bid Security of all Bidders will be returned (unless previously forfeited as aforesaid) upon (1) the execution of the construction Agreement by the Owner (provided in the case of the Bidder with whom said Agreement is entered into, all required evidences of insurance and Bonds have been previously delivered to the Owner) or (2) the rejection by the Owner of all bids or (3) the expiration of the firm-bid period, including any extensions by operation of law or by mutual consent of the Owner and the apparently lowest responsible Bidder.

Paragraph 4.3 - Submission of Bids:

ADD the following new sentence to the end of Subparagraph 4.3.2 as follows:

4.3.2 [*Add:*] "The Owner shall not be responsible for the opening of Bids not submitted in compliance with these Instructions to Bidders or Supplementary Instructions to Bidders."

ADD new Subparagraph 4.3.8 as follows:

4.3.8 [*Add:*] The documents to be submitted on bid day are as follows:

1. Two (2) Original Bid Form
2. Two (2) Bid Security
3. Two (2) Non-Collusion Affidavit
4. Two (2) Non-Discrimination Affidavit
5. Two (2) Contractor's Qualification Statement, AIA Document A305

ADD new Subparagraph 4.3.9 as follows:

4.3.9 [*Add:*] The Owner reserves the right to waive non-material defects or informalities in any and all bids to the full extent that Virginia law permits.

Paragraph 4.4 - Modification or Withdrawal of Bid:

DELETE Subparagraph 4.4.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

4.4.1 A Bidder may withdraw its Bid at any time up to the scheduled time for opening of Bids. The withdrawal of a Bid prior to the deadline for bidding may occur only by appearing in person, by First-Class mail, or by fax. A Bid may not be modified after the deadline for submittal. After the deadline for submittal, no Bid may be withdrawn except as permitted by the Procurement Code of the Commonwealth of Virginia.

MODIFY the first sentence of Subparagraph 4.4.2 as follows:

4.4.2 [*Modify:*] "…… and these Bidding Documents."

DELETE Subparagraph 4.4.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

4.4.3 Bids may not be withdrawn by the Bidder for a period not to exceed 60 calendar days following the actual date of opening thereof, except as provided under the Virginia Public Procurement Act. However, if award of Contracts is delayed by a required approval of another government agency, the sale of bonds or the award of a grant or grants, the Bids may not be withdrawn by the Bidder for a period not to exceed 60 days from the date of Bid opening in accordance with Virginia Law.

4.5 Confidentiality

ADD a new paragraph 4.5 as follows:

4.5 Confidentiality

4.5.1. Bidders should give specific attention to the identification of those portions of their response which they deem to be confidential, proprietary information or trade secrets, and provide any justification of why the Owner should not disclose such materials, upon request. The Owner is a public body subject to the Virginia Freedom of Information Act (Va. Code § 2.2-3700 et seq.) and must disclose information, upon request, unless the law contains an exception permitting FCPS to withhold the information. The submissions of Bidders are also subject to the provisions of Virginia Code § 2.2-4342(F) and this section.

4.5.2 Bidders must clearly indicate each page that is deemed confidential, proprietary or a trade

secret. Bidders may NOT preface their entire response with a proprietary statement; such statements will not be effective to prevent disclosure of any portion of the response. Bidders should submit physical materials in such a way that pages marked as confidential, proprietary, or trade secrets can be readily separated, physically, from portions of the submission that are not so marked.

4.5.3 If the Owner determines that a page that a Bidder has designated "confidential" or "trade secret" is not entitled to protection from public disclosure under FOIA and Virginia Code § 2.2-4342(F), the Owner will provide notice of that determination to the contact person designated by the Bidder, in any reasonable manner that the Owner can provide such notice. If the Bidder does not initiate judicial proceedings to protect the confidentiality of the document within five (5) business days after the designated person received such notice, the Owner will not have any obligation to withhold the document from public disclosure.

4.5.4 By submitting to the Owner a page that a Bidder designates as "confidential" or "trade secret", the Bidder agrees that in the event a third party brings any action against the Owner or any of its officials or employees to obtain disclosure of the document, the Bidder will indemnify and hold harmless the Owner and each organization's affected officials and employees from all costs, including attorney's fees, incurred by or assessed against any defendant, of defending against such action. The Bidder also agrees that at the Owner's request the Bidder will intervene in any such action and assume all responsibility for defending against it, and that the Bidder's failure to do so will relieve the Owner of all further obligations to protect the confidentiality of the document. All materials and information submitted during the ITB process will become the property of the Owner and will not be returned to the Proposer, except for the financial information, which shall be returned upon request after the Owner has determined to discontinue the procurement, or after the award of the contract.

4.6 – Owner's Officers/Employees Not to Benefit.

ADD a new paragraph 4.6 as follows:

4.6 OWNER'S OFFICERS/EMPLOYEES NOT TO BENEFIT.

4.6.1 Each Bidder's submission of a bid constitutes such Bidder's certification that that to the best of their knowledge no official or employee of Owner having official responsibility for the procurement transaction or member of his or her immediate family has received or will receive any financial benefit of more than nominal or minimal value relating to an award under this solicitation. If such a benefit has been received or will be received this fact shall be disclosed with the bid or as soon thereafter as it appears that such a benefit will be received. Failure to disclose the information prescribed above may result in suspension or debarment or recession of the contract made or could affect payment pursuant to the terms of the contract.

4.6.2 By submitting their bid, Bidders certify that their proposals are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other Bidder, supplier, manufacturer or subcontractor in connection with their bid, and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised unless consideration of substantially equal or greater value was exchanged.

4.6.3 Whenever there is reason to believe that benefit of the sort described in the paragraphs above has been or will be received in connection with bid, proposal or contract and that a Bidder has failed to disclose such benefit or has inadequately disclosed it, the Owner, as a prerequisite to payment pursuant to the agreement, or at any time may require the Bidder to furnish, under oath, answers to any interrogatories related to such possible benefit.

4.6.4 In the event a Bidder has knowledge of benefits as outlined above, this information should be submitted with the bid. If the above does not apply at time of award of contract and becomes known after inception of a contract the Bidder/Offeror shall address the disclosure of such facts to Owner's Budget Director.

ARTICLE 5 -CONSIDERATION OF BIDS

Paragraph 5.1 - Opening of Bids:

DELETE the first part of the first sentence of Paragraph 5.1 up to and including "or when otherwise required by law," and begin this sentence as follows:

5.1 "Bids properly identified and received ……"

5.1.1 Post Bid Assessment: To the full extent permitted under Section 2.2-4318 of the Code of Virginia, if the amount of the lowest responsible and responsive bid exceeds available funds, the Owner reserves the right to consider changes in the Work after Bid opening and prior to award of Contracts intended to reduce the cost of the Project. The Owner may at its election, begin discussions with the lowest responsible Bidder, based on low Base Bid and any Alternates determined to be acceptable to the Owner. After Bid opening and upon the Owner's identification of the apparent low bidder and the Owner's request, the apparent low bidder agrees to provide cost breakdowns in accordance with estimates used in the preparation of its Bid to the Owner and Architect, using cost breakdown forms that will be provided by the Architect. The confidentiality of such cost-breakdown and bid materials, when received, will be maintained by the Owner, the Architect and their representatives to the extent permitted by law. Such requests will be made only where, in the sole judgment of the Owner, the Owner's ability to fully fund the Project is detrimentally affected by the total amount of the lowest responsible and responsive Bids and accepted Alternates received from all Bidders. Matters to which such requests could be directed may include site work, landscaping, predetermined means and methods of construction, substitutions, deletions, changes in scope, and changes in schedule. Following receipt of the information requested, the Owner may propose deletions of Work and may at its option prepare draft deduct Change Orders. The Owner's award of the Contract to the Bidder can be made conditional upon the Bidder's consent and agreement to the execution of the proposed deduct Change Orders, following award and at a time contemporaneous with the execution of the Owner-Contractor Agreement. If through this process the Owner cannot achieve the cost reductions necessary to meet its budget parameters, the Owner reserves the right to reject all Bids associated with the Contract and re-bid the Project.

5.1.2 Each firm may submit only one bid. In the event a firm submits more than one bid, all bids that such firm submits will be disqualified.

Paragraph 5.2 - Rejection of Bids:

ADD new Subparagraph 5.2.1 as follows:

5.2.1 The Owner reserves the right to reject any or all Proposals, or parts thereof, or items therein. The Owner reserves the right to disqualify Bids, before or after opening, upon evidence of collusion with intent to defraud or other illegal practices upon the part of the Bidder, or by other means permissible under applicable law.

Paragraph 5.3 - Acceptance of Bid Award:

AMPLIFY Subparagraph 5.3.1 as follows:

5.3.1 [*Amplify:*] The Owner, before making an award, may require any Bidder, upon at least three (3) days request to present satisfactory evidence, in the form specified by the Owner, of their experience, qualifications, financial ability, and other matters reasonably related to their ability to satisfactorily perform and complete the Work covered by their Bid.

The Owner reserves the right to consider such matters, facts and circumstances presented by the Bidder, as shall be permitted by Virginia law, in making a determination whether the Bidder is a responsible Bidder. The Owner reserves the right to request such other information or data as they may deem necessary to evaluate the qualifications of the Bidder to satisfactorily perform the functions of the Contractor.

The Bidder must submit a Contractor's Qualification Statement (AIA Document A305) in order to assist the Owner in determining whether a Bidder is responsible. The Owner would be pleased, as part of such evaluation, to review and consider any similar projects completed within the past 7 years of a minimum Contract value equal to or greater than the Bid amount of this Project. Also, provide names and numbers for the locality officials or the Construction Manager, if applicable, and the Architect for all similar projects completed within the past 7 years.

The Contractor's Qualification Statement may be supplemented by listing any principal, officer, or shareholder in your company who has either owned, operated or who was affiliated with any other business in a management capacity, under a different name. List the name of the business and provide a Contractor's Qualification Statement for such business.

ADD new Subparagraphs as follows:

5.3.5 After review of the Bids, during the Bid period stipulated in Article 4.4.1, at its sole discretion, the Owner may issue a Notice of Intent to Award. Upon receipt of Notice of Intent to Award, the Contractor shall, within five (5) calendar days, deliver to the Owner (by delivery to the Architect) the following:

1. Performance and Payment Bonds as set forth in the Contract Documents and Article 7 of the Instructions to Bidders.

2. Insurance Certificate, policies or other evidence of insurance set forth in the Contract Documents.
3. Post Bid Information required in Article 6 of the Instructions to Bidders.

Failure of the Bidder to whom Notice of Intent to Award has been given to deliver the above items required by the Contract Documents, within five (5) days, shall constitute grounds for the Owner to declare the Bidder's Bid Security forfeited.

Upon receipt of the documents listed above, the Owner may at its sole discretion, award the Contract. A written Notice to Proceed will be issued to establish the start of the Contract duration.

5.3.6 Upon receipt of the partially executed Agreement from the Contractor, the Owner shall execute and return to the Contractor, one (1) copy of the executed Agreement and shall issue the Notice to Proceed for the Work.

5.3.7 When a Unit Price is rejected by the Owner, any additional work that would have been subject to that unit price shall be subject to Article 7 of the General Conditions of the Contract for Construction and the Supplementary General Conditions.

ARTICLE 6 - POST BID INFORMATION

DELETE Paragraph 6.1 in its entirety. SUBSTITUTE the following paragraph:

[Substitute:] 6.1 As a matter of policy, the Owner does not endorse the products or services of a contractor. News releases concerning any resultant contract from this solicitation will not be made by a contractor without the prior written approval of the Owner. All proposed news releases will be routed to the Owner's Budget Director for review and approval.

DELETE Paragraph 6.2 - Owner's Financial Capability, in its entirety.

ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

Paragraph 7.1 - Bond Requirements:

DELETE Subparagraph 7.1.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.1.1 Prior to execution of the Contract, the successful Bidder shall furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in the forms included in the Project Manual and each in an amount equal to 100% of the Contract Amount. The Performance Bond shall remain in force and effect until the Contractor's Work has been finally accepted. The Bidder shall pay all premiums with respect to such bonds.

DELETE Subparagraph 7.1.2 in its entirety.

DELETE Subparagraph 7.1.3 in its entirety, and in lieu thereof, SUBSTITUTE the following new

Subparagraph:

7.1.3 Bonds shall be secured from a surety company as stipulated in Section 000750 Supplementary General Conditions.

Paragraph 7.2 - Time of Delivery and Form of Bonds:

DELETE Subparagraph 7.2.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.2.1 The Bidder shall deliver properly executed bonds to the Owner (by delivery to the Architect) no later than five (5) days after written Notice of Intent to Award is issued.

DELETE Subparagraph 7.2.2 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.2.2 Bonds shall be written on the Performance Bond form and the Payment Bond form included in the Contract Documents for the amount required in the Contract Documents.

7.2.2.1 The Contract Bonds shall be written in the form included in the Project Manual and the Bonds shall be executed by or on behalf of the successful Bidder, as Principal, in the following manner:

7.2.2.2 If the successful Bidder is an individual, the Contract Bonds shall be executed by them personally, their signature shall be witnessed and any trade name employed in the conduct of their business shall be stated.

7.2.2.3 If the successful Bidder is a partnership, the Contract Bonds shall be executed in the name of the partnership by each of the Partners, and the signatures of the Partners shall be witnessed.

7.2.2.4 If the successful Bidder is a corporation, the Contract Bonds shall be executed in the name of the corporation: (1) by the President or a Vice President and attested by the Secretary or Assistant Secretary and the Corporate Seal shall be attached; (2) by a duly authorized agent of the corporation whose authority to act, as of the date of the Contract Bonds, shall be established by proof, satisfactory to the Owner, attached to the Contract Bonds.

7.2.2.5 If the successful Bidder is a limited liability company, the Contract Bonds shall be executed in the name of the limited liability company: (1) by a Manager, in the case of a Manager-managed limited liability company; or (2) in the case of a limited liability company that is not Manager-managed, by a duly authorized Member or other officer of the limited liability company, whose authority to act, as of the date of the Contract Bonds, shall be established by proof, satisfactory to the Owner, attached to the Contract Bonds.

7.2.2.6 Execute the Contract Bonds in behalf of the surety in such manner as to legally bind the surety. In the event the execution in behalf of the surety is by an agent or agents, a proper power of attorney, evidencing the authority of such agent or agents, shall be attached to the Contract Bonds. Such power of attorney shall bear the same date as the Contract Bonds to which it is attached.

7.2.2.7 Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

ARTICLE 8 - ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

DELETE Subparagraph 8.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

8.1 The Agreement shall be written on the form included in these Contract Documents.

ARTICLE 9 CONSTRUCTION TIME

ADD new Article 9 as follows:

Paragraph 9.1 - Pre-Bid Conference:

9.1.1 Prospective Bidders and Sub-bidders are invited to attend a Pre-Bid Conference at the time and location stated in the Advertisement for Bids during which questions of general and technical nature and other matters regarding the Construction Documents may be raised by those in attendance and discussed with the Owner, the Architect and the Engineers.

Paragraph 9.2 - Pre-Construction Conference:

9.2.1 Soon after the award of the Contract but prior to the start of construction, the Contractor or their representative shall attend a Pre-Construction Conference with representatives of the The City of Staunton, VA and the Architect. The conference will serve to acquaint the participants with the general plan of Contract administration and requirements under which the construction operation is to proceed and will inform the Contractor, in detail, of the obligations imposed on them and their subcontractors by the Executive Orders concerning Equal Employment Opportunity.

9.2.2 The date, time and place of the conference will be furnished to the Contractor by the Architect.

Paragraph 9.3- Contract Time:

9.3.1 The Agreement will include a stipulation that the Work be substantially complete (as defined in the Contract) by the date indicated on the Bid Form, and that completion of ALL punch list work and Final Acceptance of the Work be achieved within (30) calendar days after Substantial Completion.

Paragraph 9.4- Time of Completion:

9.4.1 The Bidder agrees that they will commence work within forty-eight (48) hours following receipt of Notice to Proceed from the Owner (which may be given by the Architect pursuant to authority granted by the Owner) and shall be substantially completed within the number of calendar days set forth herein.

9.4.2 By submitting a Bid, the Bidder certifies that they shall coordinate the schedule for the construction of the Project including, but not limited to, preparing and updating the Schedule.

9.4.3 By submitting a Contract Bid, the Bidder certifies that the Contract Time set forth herein is sufficient for the Bidder to complete its Work.

Paragraph 9.5- Non-Interference with Owner's Operations:

9.5.1 The Contractor shall schedule their Work accordingly and shall cooperate with the Owner to see that daily operations are disrupted as little as possible. No work shall begin until it is fully coordinated with the Owner so that the Owner can make provisions to allow for the disruption that the work will cause. This notice shall be in writing.

9.5.2 The Contractor shall erect temporary barriers to segregate the area of new construction from the existing facility and remainder of the Owner's property. It is the intention that these temporary barriers be constructed to prevent the flow of dust dirt, debris, etc., into the adjacent areas of the facility. The temporary barriers must also serve as safety barriers to prevent access of unauthorized people into the work area.

9.5.3 The Contractor must maintain access to the Owner's facilities for employees, visitors, other users, and deliveries. In no way shall the Contractor prevent access to the remaining portions of the site.

ARTICLE 10 - GOVERNING LAWS AND REGULATIONS

ADD new Article 10 as follows:

Paragraph 10.1 – Governing Laws and Regulations

10.1.1 The Bidder's attention is directed to the fact that all applicable Federal and State laws, municipal ordinances and codes, and the rules and regulations of all authorities having jurisdiction over construction of the Project may apply to this Contract, including without limitation.

END OF SECTION 000101

BID FORM - GENERAL CONSTRUCTION – Architect's Project No: 630874
City of Staunton IFB#C00124

DATED: _____
(Bidder to insert date bid submitted)

Bidder's Name and Address (Print or Type)

_____

City of Staunton, VA

_____

116 W. Beverley St
Staunton, VA 24401

_____

To Whom It May Concern:

This Bid is submitted in accordance with your Advertisement inviting Bids to be received for the General Construction Work for Staunton J&DR Courts Facility, City of Staunton, VA.

Having carefully examined the Contract Documents as defined in Article 1 of the Agreement, bound in the Specifications, and including the Addenda enumerated in the Bid, which are incorporated with these documents indicating various conditions affecting this Contract, the undersigned herein agrees to furnish all materials, perform all labor and do all else necessary to complete the Contract for the above-named Project in accordance with said Contract Documents for:

Total Base Bid Project Cost for All General Construction (INCLUDING ALLOWANCES)

_____ DOLLARS

($_____).

Accompanying this Bid is a certified check, bank cashier's check, bank treasurer's check or Bid Bond required by Paragraph 4.2 of the Instructions to Bidders which is deposited as a bid guarantee, and is to be retained by you and applied as provided in Paragraph 4.2.1 of the Instructions to Bidders, in case the undersigned shall default in executing the Contract or in furnishing the required Bonds and insurance certificates within the time specified by these Contract Documents.

The undersigned hereby certifies that this Bid is genuine, and is not a sham or collusive, or made in the interest of, or on behalf of any person, firm or corporation not herein named, and that the undersigned has not directly or indirectly induced or solicited any bidder to refrain from bidding and that the undersigned has not in any manner sought by collusion to secure for itself, any advantages over any other bidder.

The undersigned, intending to be legally bound, agrees that this Bid shall be irrevocable and shall remain subject to your acceptance for 60 days after the date set for bid opening.

It is hereby certified that the undersigned is the only person(s) or entity(ies) interested in this Bid as Principal, and that the Bid is made without collusion with any person, firm or corporation. The Bidder hereby agrees to furnish surety company bonds in the form incorporated in the Contract Documents, in the amount of one hundred percent (100%) of the Contract Price for the Performance Bond and the Payment Bond as surety against defects or inferior materials or workmanship which may develop during the period of one (1) year from the date of completion and acceptance of the Work performed under the Contract, within ten (10) days after notice by the Owner of the intention to award the Contract and execute the Agreement and furnish evidence of required insurance coverage, upon request, within ten (10) days after mailing by the Owner of Notice of Intent to Award, and to commence work within forty-eight (48) hours after receipt of Notice to Proceed.

The Bidder guarantees that, if awarded a Contract, it will furnish and deliver all materials, all specified temporary facilities and controls, tools, equipment, tests, and transportation, to secure all permits and licenses, to do and perform all labor, superintendence, and all means of construction, pay all fees (unless specifically noted otherwise), and do all incidental Work, and to execute, construct and finish, in an expeditious, substantial and workmanlike manner in accordance with the plans and specifications, to the complete satisfaction and acceptance of the Owner for the price herein stated.

It is understood that the City of Staunton reserves the right to reject any or all Bids or Proposals, or parts thereof, or items thereof, and to waive technicalities required for the best interests of the Owner.

The undersigned submits this Bid with the full knowledge of the Contract requirements and hereby agrees that Work of this Project, under this Contract, shall be **substantially completed by November 1st, 2025,** which period shall be the essence of the Contract. Each phase of construction will have its own substantial completion date. See Section 011000 Summary of Work.

The Bidder agrees that it will not assign its Bid or any of its rights or interests hereunder without written consent of the Owner.

The undersigned Contractor agrees to furnish all labor and materials for any additional work ordered by the Owner, and for which no pre-agreed price has been fixed, for the net cost of all labor and materials furnished plus the contracted markup noted in Article 6 of the Supplementary General Conditions.

THE BID FORM AND THE FOLLOWING ATTACHMENTS SHALL BE SUBMITTED IN DUPLICATE:

1. Two (2) Bid Security
2. Two (2) Contractor's Qualification Statement (AIA Document A305)
3. Two (2) Virginia SCC number
4. Two (2) Non-Collusion Affidavit

ALLOWANCES: The Instructions to Bidders and the Contract Documents comprising the plans and specifications, and all documents bound therewith, together with all Addenda thereto, shall apply to all Allowances and Unit Prices as listed in Division 1 Sections "Allowances", "Unit Prices", and as listed below:

Lump Sum Allowance #1: Interior and Exterior Panel Signage $50,000.

Quantity Allowance #1: Moisture Vapor Treatment (MVT):

Provide quantity of 20,000 square feet (sf) at $_____ per sf (in-place unit price/measurement);

for a total allowance amount of $_____ (figures only)
The Owner reserves the right to accept or reject any and all Unit Prices stipulated on the Bid Form.

ADDENDA

The undersigned hereby acknowledge receipt of following Addenda and has prepared this bid accordingly:

ADDENDUM #_____	Dated_____	ADDENDUM #_____	Dated_____
ADDENDUM #_____	Dated_____	ADDENDUM #_____	Dated_____

Bids shall be officially signed in accordance with the Instructions to Bidders, using the applicable portion of the "Signature Pages".

SIGNATURES

IN WITNESS WHEREOF, the undersigned has caused this Bid to be executed as of the day and year indicated on the first page hereof.

For Individual Bidder

_____
Name of Bidder (Printed)

_____ By: _____
Witness (Signature of Individual)

Trading and doing business as *_____

Business Address_____

*If a fictitious or trade name is employed in the conduct of business, insert name here:

_____

Next, complete, by deletion as appropriate, the following statement:

Foregoing fictitious or trade name (has) (has not) been registered by the individual proprietorship under Virginia Law.

SIGNATURES

IN WITNESS WHEREOF, the undersigned has caused this Bid to be executed as of the day and year indicated on the first page hereof.

For Partnership Bidder

*_____
(Name of Partnership)

_____
Name of General Partner (Printed)

_____ By: _____
Witness (Signature of General Partner)

Business Address_____

The Partners constituting the Partnership herein named are:

Partner	Address
Partner	Address
Partner	Address
Partner	Address

[Add additional lines for the names and addresses of additional Partners, if there are more than four Partners in the Partnership, by attaching an additional page or pages to this Bid.]

*If a fictitious or trade name is employed by the Partnership in conduct of its business, insert name here:

_____

Next, complete, by deletion as appropriate, the following statement:

Foregoing fictitious or trade name (has) (has not) been registered by the partnership under Virginia Law.

SIGNATURES

IN WITNESS WHEREOF, the undersigned has caused this Bid to be executed as of the day and year indicated on the first page hereof.

For Corporate Bidder

_____

(Name of Corporation)

By:_____
Signature of President, Vice President, or other authorized representative *

Attest:_____
Signature of Secretary, Assistant Secretary, Treasurer, Assistant Treasurer or other authorized representative **

(CORPORATE SEAL)

Business Address_____

* If a representative other than the President or a Vice President of the Corporation signs this Bid on its behalf, then attach a valid corporate resolution or other appropriate proof, dated prior to or as of the date of the Bid, evidencing authority to execute this Bid on behalf of the Corporation.

** If a representative other than the Secretary, an Assistant Secretary, the Treasurer or an Assistant Treasurer attests to the signature of the corporate representative, then attach a valid corporate resolution or other appropriate proof, dated prior to or as of the date of the Bid, evidencing authority to attest to the execution of this Bid on behalf of the Corporation.

(1) Complete the following statement:

The Corporation has been organized and is existing under laws of the State/Commonwealth of

_____

(2) If the Corporation has been organized under laws of a State other than those of the Commonwealth of Virginia, complete, by deletion as appropriate, the following statement:

The Corporation (has) (has not) been granted a certificate of authority to do business in the Commonwealth of Virginia under applicable laws.

(3) If the Corporation has been organized under laws other than those of the Commonwealth of Virginia and has NOT been granted a certificate of authority, complete, by deletion as appropriate, the following statement:

The Corporation (has) (has not) applied for a certificate of authority to do business in the Commonwealth of Virginia and (has) (has not) attached a copy of the pending application to this Bid.

SIGNATURES

IN WITNESS WHEREOF, the undersigned has caused this Bid to be executed as of the day and year indicated on the first page hereof.

For Limited Liability Company (LLC) Bidder

[Name of Contractor]

_____
(Print Name of Limited Liability Company)

Attest:_____ By: _____
Signature of an authorized representative* Signature of an authorized representative**

* The individual attesting verifies and represents that the person whose signature is affixed to this Bid on behalf of the Limited Liability Company (LLC) is duly authorized in accordance with the representations hereafter set forth.

** Check the box which applies to this Bid:

□ The Certificate of Organization or operating agreement provide that the LLC is to be managed by managers, and this Bid has been executed by a Manager fully authorized by the Certificate, by the Operating Agreement and by Resolutions of the LLC. Copies of the relevant documents are provided with the Bid or can be provided upon request within three (3) working days.

□ The Certificate of Organization and operating agreement do not provide that LLC is to be managed by managers, and this Bid has been executed by a Member fully authorized by the Certificate, by the Operating Agreement and by Resolutions of the LLC. Copies of the relevant documents are provided with the Bid or can be provided upon request within three (3) working days.

□ This Bid has been executed by a representative of the LLC who is not a Manager or a Member of the LLC, and instead who holds the office of _____ (insert title), and the execution of this Bid is fully authorized by the Certificate, by the Operating Agreement and by Resolutions of the LLC. Copies of the relevant documents are provided with the Bid or can be provided upon request within three (3) working days.

The Bidder and the individuals signing and attesting to the execution of this document further represent that (1) execution of the Bid is carrying on business in the usual way; (2) the LLC authorizes the execution of this Bid even if execution and submission of this Bid is not carrying on business in the usual way for the LLC; and (3) to the best of the individuals' information and belief, the Owner has no knowledge of the Member's or the Manager's lack of actual authority, or of any applicable and relevant restriction on his or her authority.

Complete the following statement:

The LLC has been organized and is existing under laws of the State/Commonwealth of:

_____

If the LLC has been organized under laws of a State other than those of the Commonwealth of Virginia, complete, by deletion as appropriate, the following statement:

The LLC (has) (has not) been granted a certificate of authority to do business in the Commonwealth of Virginia under applicable laws.

If the LLC has been organized under laws other than those of the Commonwealth of Virginia and has NOT been granted a certificate of authority, complete, by deletion as appropriate, the following statement:

The LLC (has) (has not) applied for a certificate of authority to do business in the Commonwealth of Virginia and (has) (has not) attached a copy of the pending application to this Bid.

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned

_____ as Principal, and

_____ as Surety, are hereby held and firmly bound unto _____ as Owner in the penal sum of _____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed, this _____ day of _____

The condition of the above obligation is such that whereas the Principal has submitted to _____ a certain bid attached hereto and hereby made a part of hereof to enter into a contract in writing, for the _____

_____

_____

_____

NOW THEREFORE,

a) If said Bid shall be rejected, or in the alternate

b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid.

Then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The surety for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within

which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____ (L.S.)
Principal

_____
Surety

By: _____

Seal

SECTION 000515 - CITY OF STAUNTON / VPPA PROJECT REQUIREMENTS

The provisions of this Section 000515 are prescribed by state or other law, and become part of the final agreement of the successful Bidder. By bidding on the Project, each Bidder signifies agreement to these provisions.

PART 1 - GENERAL

1.1 ANTI-DISCRIMINATION:

By submitting proposals, Bidders certify to Owner that they will comply with the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Contracting Act of 1975, as amended, when applicable, the Virginians With Disabilities Act, the Americans With Disabilities Act and § 2.2-4311 of the *Virginia Public Procurement Act (VPPA).*

In every contract over $10,000 the provisions in 1. and 2. below apply:

1. During the performance of this contract, the contractor agrees as follows:

    a. The contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

    b. The contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such contractor is an equal opportunity employer.

    c. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting these requirements.

2. The contractor will include the provisions of 1. above in every subcontract or purchase order over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

1.2 ETHICS IN PUBLIC CONTRACTING:

A. By submitting proposals, Bidders certify that their proposals are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other Bidder, supplier, manufacturer or subcontractor in connection with their proposal, and that they have not conferred on any public employee having official responsibility for this procurement

transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value was exchanged Work covered by Contract Documents.

1.3 IMMIGRATION REFORM AND CONTROL ACT OF 1986:

A. By entering into a written contract with Owner, the Contractor certifies that the Contractor does not, and shall not during the performance of the contract for goods and services for Owner, knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986.

1.4 DEBARMENT STATUS:

By participating in this procurement, the Bidder certifies that it is not currently debarred by the Commonwealth of Virginia or Owner from submitting a response for the type of goods and/or services covered by this solicitation. Bidder further certifies that they are not debarred from filling any order or accepting any resulting order, or that it is are an agent of any person or entity that is currently debarred by the Commonwealth of Virginia or Owner.

1.5 RECORDS RETENTION:

If successful, the Bidder hereby agrees to retain all books, records, and other documents relative to this contract for three (3) years after final payment, or until audited by the Owner, whichever is sooner. The Owner, its authorized agents, and/or auditors reserve the right to perform or have performed an audit of the records of the Contractor pertaining to this Project and therefore shall have full access to and the right to examine any of said materials within a reasonable period of time during said period.

1.6 ANTITRUST.

By entering into a contract pursuant to this solicitation, the Bidder conveys, sells, assigns, and transfers to the Owner all rights, title and interest in and to all causes of the action it may now have or hereafter acquire under the antitrust laws of the United States and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by the Owner under said contract.

1.7 CHARGES AND PAYMENTS TO SUBCONTRACTORS—GENERAL:

A. Payment to Subcontractors From Funds that Contractor Receives.

1. A Bidder awarded a contract under this solicitation is hereby obligated:

(a) To pay the subcontractor(s) within seven (7) days of the Bidder's receipt of payment from Owner for the proportionate share of the payment received for work performed by the subcontractor(s) under the contract; or

(b) To notify the Owner and the subcontractor(s), in writing, of the Bidder's intention to withhold payment and the reason.

2. The Bidder is obligated to pay the subcontractor(s) interest at the rate of one percent per month (unless otherwise provided under the terms of the contract) on all amounts owed by the Bidder that remain unpaid seven (7) days following receipt of payment from Owner, except for amounts withheld as stated in (A)(1)(b) above. The date of mailing of any payment by U. S. Mail is deemed to be payment to the addressee. These provisions apply to each sub-tier contractor performing under the primary contract. An Bidder's obligation to pay an interest charge to a subcontractor is not an obligation of Owner.

B. Payment to Subcontractors When Contractor Has Not Received Funds

In the event that the Bidder awarded a contract under this solicitation has not received payment from the Owner for work performed by a subcontractor under such contract, such Bidder is liable for the entire amount owed to such subcontractor and to pay such subcontractor within 60 days of the receipt of an invoice following satisfactory completion of the work for which the subcontractor has invoiced. Such Bidder shall not be liable for amounts otherwise reducible due to the subcontractor's noncompliance with the terms of the contract. However, in the event that the Bidder withholds all or a part of the amount invoiced by the subcontractor under the terms of the contract, the contractor shall notify the subcontractor within 50 days of the receipt of such invoice, in writing, of his intention to withhold all or a part of the subcontractor's payment with the reason for nonpayment, specifically identifying the contractual noncompliance, the dollar amount being withheld, and the lower-tier subcontractor responsible for the contractual noncompliance. Payment by the party contracting with the contractor shall not be a condition precedent to payment to any lower-tier subcontractor, regardless of that contractor's receiving payment for amounts owed to that contractor. This paragraph shall not apply to any amounts withheld as retainage under the applicable contract.

C. Tax Identification Numbers.

Individual contractors or subcontractors shall provide their social security numbers. Proprietorships, partnerships, and corporations (or other entities taxed as one of the foregoing under federal law) shall provide their federal employer identification numbers.

1.8 QUALIFICATIONS OF BIDDERS

A. By submitting a proposal, a Bidder authorizes Owner to make such reasonable investigations with the Bidder and with any third party, as deemed proper and necessary in the sole discretion of the Owner to determine the ability of the Bidder to perform the services under this Bid, and the Bidder also authorizes the third party to provide any information requested by Owner, even if the information is adverse to the Bidder. Owner reserves the right to inspect Bidder's physical facilities and previous work and record prior to award to satisfy questions regarding the Bidder's

capabilities. Owner further reserves the right to reject any proposal if the evidence submitted by, or investigations of, such Bidder fails to satisfy Owner that such Bidder is fully qualified to carry out the obligations of the contract and to provide the procured services in all respects.

1.9 TAXES:

Sales to Owner are exempt from State sales tax. State sales and use tax certificates of exemption, Form ST-12, will be issued upon request, as Owner determines appropriate.

1.10 DRUG-FREE WORKPLACE

A. During the performance of a contract, the Bidder agrees to: (1) provide a drug-free workplace for the Bidder's employees; (2) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Bidder's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (3) state in all solicitations or advertisements for employees placed by or on behalf of the Bidder that the Bidder maintains a drug-free workplace; and (4) include the provisions of the foregoing clauses in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

B. For the purposes of this section, "*drug-free workplace"* means a site for the performance of work done in connection with a specific contract awarded to a contractor, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

1.11 AVAILABILITY OF FUNDS:

It is understood and agreed between the parties herein that Owner shall be bound and liable hereunder only to the extent of the funds appropriated by the governing body of the City of Staunton for the purpose of this Contract

1.12 AUTHORIZATION TO CONDUCT BUSINESS IN THE COMMONWEALTH:

A Bidder organized as a stock or nonstock corporation, limited liability company, business trust, or limited partnership or registered as a registered limited liability partnership shall be authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the *Code of Virginia* or as otherwise required by law. Any business entity described above that enters into a contract with a public body pursuant to

the *Virginia Public Procurement Act* shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth, if so required under Title 13.1 or Title 50, to be revoked or cancelled at any time during the term of the contract. Owner may void any contract with a business entity if the business entity fails to remain in compliance with the provisions of this section. Any LLC Bidder's signatory to any document related to this procurement shall be regarded as a declaration under penalty of perjury that the signatory has full authority to execute the document as a legally binding obligation of the LLC and there are no restrictions or conditions to the LLC's contractual commitment or the execution of all documents related thereto.

1.13 PUBLIC INSPECTION OF PROCUREMENT RECORDS:

A. Proposals submitted shall be subject to public inspection only in accordance with Section 2.2-4342 of the Code of Virginia as follows:

1. Except as provided in this section, all proceedings, records, contracts and other public records relating to procurement transactions shall be open to the inspection of any citizen, or any interested person, firm or corporation, in accordance with the Virginia Freedom of Information Act (§ 2.2-3700 et seq.).

2. Cost estimates relating to a proposed procurement transaction prepared by or for a public body shall not be open to public inspection.

3. Any competitive negotiation Bidder, upon request, shall be afforded the opportunity to inspect proposal records within a reasonable time after the evaluation and negotiations of proposals are completed but prior to award, except in the event that the public body decides not to accept any of the proposals and to reopen the contract. Otherwise, proposal records shall be open to public inspection only after award of the contract.

4. Any inspection of procurement transaction records under this section shall be subject to reasonable restrictions to ensure the security and integrity of the records.

5. Trade secrets or proprietary information submitted in connection with a procurement transaction or prequalification application consistent with and pursuant to subsection B of § 2.2-4317 shall not be subject to the Virginia Freedom of Information Act (§ 2.2-3700 et seq.); however, the Bidder shall (a) invoke the protections of this section prior to or upon submission of the data or other materials, (b) identify the data or other materials to be protected, and (c) state the reasons why protection is necessary, all to the extent required by law.

1.17 COMPANY WORKSITE BADGE

All Contractors working onsite must have a visible company badge at all times. The badge must include the company name, name of employee and a photo of the employee.

1.18 CERTIFICATION OF INTEREST & RELATIONSHIPS WITH CITY OF STAUNTON, STAUNTON CITY COUNCIL, SCHOOL BOARD AND STAUNTON PUBLIC SCHOOL EMPLOYEES.

The extent that neither Offeror nor any of Offeror's officers, directors, or executive employees maintains a financial or familial or any business relationship with any person acting for, or employed by, City of Staunton or Staunton City Council and SCS or Staunton City School Board members of the Board itself, the offeror shall reveal and fully describe such relationships in writing, which shall be made public. In accordance with this paragraph, the offeror shall execute the certification attached hereto as Attachment A and submit the certification contemporaneously with this executed Contract.

1.19 PROOF OF STATE CORPORATION COMMISSION NUMBER

All prime and subcontractors shall certify that it is authorized to transact business in the Commonwealth of Virginia as a domestic or foreign business entity by providing proof of registration with the VA Corporation Commission.

END OF SECTION 000515

ATTACHMENT A
CERTIFICATION OF INTEREST & RELATIONSHIPS
WITH CITY OF STAUNTON, STAUNTON CITY COUNCIL,
SCHOOL BOARD AND STAUNTON PUBLIC SCHOOL EMPLOYEES

Contractor hereby certifies that neither Contractor, nor any of Contractor's officers, directors, or executive employees maintain a financial of familial relationship with any person acting for, or employed by, the City of Staunton, Staunton City Council, School Board, or Staunton Public Schools (City Employee).

To the extent that such relationships exist, Contractor shall reveal the relationship below by describing the nature of the relationship and identifying the person with whom such relationship exists.

Neither Contractor nor any of its officers, directors, or executive employees maintain a financial or familial relationship with any person acting for, or employed by, the City of Staunton, Staunton City Council, School Board, or Staunton Public Schools.

The following individuals currently maintain a ***financial*** relationship with Contractor.

City Employee's Name: _____

Position with City: _____

Nature of Relationship: _____

_____

The following individuals currently maintain a ***familial*** relationship with Contractor.

City Employee's Name: _____

Position with City: _____

Nature of Relationship: _____

_____

Contractor: _____ Date: _____

By: _____

Name: _____

Title: _____

SECTION 000516 EMPLOYMENT VERIFICATION ACT

The provisions of this Section 000516 are prescribed by state or other law, and become part of the final agreement of the successful Bidder. By bidding on the Project, each Bidder signifies agreement to these provisions.

1. The Contractor and all subcontractors shall comply with applicable Federal and State laws, regulations, and processes regarding employment eligibility verification including but not limited to those laws contained in the Virginia Public Procurement Act. Without limiting the foregoing, the Contractor shall submit to Owner or Architect, evidence of compliance with Federal and State (VPPA) employment eligibility verification rules and regulations, including submission of required Federal and State employment eligibility verification forms, at or prior to the time the Contract is executed. No Contract shall be formally awarded or executed unless the Contractor has complied with all applicable Federal and State employment eligibility verification rules. The Contractor shall ensure all subcontractors comply with Federal and State employment eligibility verification rules and regulations and obtain and submit all required employment eligibility verification forms from subcontractors.

2. Subcontracts between and among the Contractor and all subcontractors shall include a requirement that all parties thereto shall comply with applicable Federal and State (VPPA) employment eligibility verification rules and regulations, including a requirement that all parties submit required Federal and State employment eligibility verification forms.

3. The Contractor or Subcontractor shall be responsible for any penalties imposed for failure to comply with applicable Federal or State (VPPA) laws regarding employment eligibility verification.

END OF SECTION 000516

AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

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)

City of Staunton, Virginia
116 West Beverley Street
Staunton, Virginia 24401
Telephone Number: 540-332-3812

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

To be determined

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

City of Staunton - J&DR District Court Facility

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

Moseley Architects P.C.
3200 Norfolk Street
Richmond, Virginia 23230
Telephone Number: 804-794-7555

The Owner and Contractor agree as follows.

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

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

AIA Document A101 – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 14:01:10 ET on 03/01/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1148405045)

TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND 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

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 a Modification, 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 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

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

AIA Document A101 – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 14:01:10 ET on 03/01/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1148405045)

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

[ ] By the following date:

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

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, 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 ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

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

Item	Price

§ 4.2.2 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

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

Item	Price

§ 4.4 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)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

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

AIA Document A101 – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 14:01:10 ET on 03/01/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1148405045)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the 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 Architect 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 Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

§ 5.1.4 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 Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 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.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 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.

§ 5.1.6.2 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 A201–2017;
- **.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 A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, 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.)

AIA Document A101 – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 14:01:10 ET on 03/01/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1148405045)

§ 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 Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, 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 at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 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.

§ 5.2 Final Payment

§ 5.2.1 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 A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

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

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

§ 5.3 Interest

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 the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the 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.)

AIA Document A101 – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 14:01:10 ET on 03/01/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1148405045)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[ ] 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 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, 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.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 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)

AIA Document A101 – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 14:01:10 ET on 03/01/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1148405045)

§ 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 A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, 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 A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, 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.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

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

.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 A101 – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 14:01:10 ET on 03/01/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1148405045)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 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 A201™–2017 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.)

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

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

AIA Document A101 – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 14:01:10 ET on 03/01/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1148405045)

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with this certification at 14:01:10 ET on 03/01/2024 under Order No. 4104248195 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A101™ – 2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum,other than changes shown in the attached final document by underscoring added text and striking over deleted text.

_____

(Signed)

_____

(Title)

_____

(Dated)

AIA Document D401 – 2003. Copyright © 1992 and 2003. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 14:01:10 ET on 03/01/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (1148405045)

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract, in strict conformity with the Drawings, Specifications and Contract Documents, then this obligation shall be null and void. Otherwise, it shall remain in full force and effect for one (1) year after completion of all work:

a. The Surety hereby waives notice of any alternation or extension of time made by the Owner.

b. Any suit under this bond must be instituted, (1) before the expiration of one (1) year after completion of the Contract including the expiration of all warranties and guarantees, or (2) before the expiration of one (1) year after a defect or breach of warranty is discovered, if the action be for such.

c. No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the successors or assigns of Owner and every action brought hereon shall be filed and maintained solely in the General District Court or the Circuit Court of the City of Staunton, Virginia.

SIGNED AND SEALED THIS _____ day of _____ , _____

In the presence of:

_____ (SEAL)
PRINCIPAL

_____
WITNESS

_____
BY TITLE

_____
SURETY

_____
WITNESS

_____
BY TITLE

Surety: (Attach power of attorney)

CONTRACTOR'S PERFORMANCE BOND

Project: _____

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS:

that _____

_____

_____

(Insert full name or legal title and address of Contractor)

as Principal, hereinafter called Contractor,

and _____

_____

_____

(Insert full name or legal title and address of Surety)

as Surety, hereinafter called Surety, are held and firmly bound unto

_____

_____

(Insert full name or legal title and address of Owner)

as Obligee for the use and benefit of claimants as herein below defined in the amount of: _____

_____

(Insert sum equal to contract price in both words and figures)

for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Contractor has by written agreement dated
entered into a Contract with Owner for:

_____

_____

(Insert name or description and location of project)

in accordance with Drawings and Specifications as prepared by: _____

_____

_____

(Insert full name or legal title and address)

which Contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Contractor shall promptly make payment to all claimants as hereinafter defined, for all labor and materials used or reasonable required for use in the performance of the Contract, then this obligation shall

be void. Otherwise, it shall remain in full force and effect, subject, however, to the following conditions:

a. A Claimant is defined as one having a direct contract with the Contractor for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

b. The above-named Contractor and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work of labor was done or performed, or materials were furnished by such claimant, may sue on this bond, prosecute the suit to final judgment for such sum or sums as many be justly due claimant and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

c. Any suit or action hereunder by any claimant:

   1. Shall not be commenced after the expiration of one (1) year following the date on which the claimant last performed labor or last supplied materials.

   2. Shall be filed and maintained solely in the General District Court or the Circuit Court of the City of Staunton, Virginia.

SIGNED AND SEALED THIS _____ day of _____
in the presence of:

_____ (SEAL)
PRINCIPAL

_____ _____
WITNESS BY TITLE

_____ (SEAL)
SURETY

_____ _____
WITNESS BY TITLE

Surety:
(Attach power of attorney)

CONTRACTOR'S LABOR AND MATERIAL PAYMENT BOND

Project _____

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

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

City of Staunton – Juvenile and Domestic Relations Courthouse
Staunton, Virginia

THE OWNER:
(Name, legal status and address)

City of Staunton, Virginia
116 West Beverley Street
Staunton, Virginia 24402
Telephone Number: 540-332-3812

THE ARCHITECT:
(Name, legal status and address)

Moseley Architects P.C.
3200 Norfolk Street
Richmond, Virginia 23230
Telephone Number: 804-794-7555

TABLE OF ARTICLES

1 GENERAL PROVISIONS

2 OWNER

3 CONTRACTOR

4 ARCHITECT

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

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.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

Init.
/

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

Init.

/

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.

User Notes: (3B9ADA46)

INDEX
(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work
9.6.6, 9.9.3, 12.3
Acceptance of Work
9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3
Access to Work
3.16, 6.2.1, 12.1
Accident Prevention
10
Acts and Omissions
3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5, 10.2.8, 13.3.2, 14.1, 15.1.2, 15.2
Addenda
1.1.1
Additional Costs, Claims for
3.7.4, 3.7.5, 10.3.2, 15.1.5
Additional Inspections and Testing
9.4.2, 9.8.3, 12.2.1, 13.4
Additional Time, Claims for
3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, 15.1.6
Administration of the Contract
3.1.3, 4.2, 9.4, 9.5
Advertisement or Invitation to Bid
1.1.1
Aesthetic Effect
4.2.13
Allowances
3.8
Applications for Payment
4.2.5, 7.3.9, 9.2, 9.3, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10
Approvals
2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9, 3.12.10.1, 4.2.7, 9.3.2, 13.4.1
Arbitration
8.3.1, 15.3.2, 15.4
ARCHITECT
4
Architect, Definition of
4.1.1
Architect, Extent of Authority
2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2, 9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1, 13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1
Architect, Limitations of Authority and Responsibility
2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4, 9.4.2, 9.5.4, 9.6.4, 15.1.4, 15.2
Architect's Additional Services and Expenses
2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4
Architect's Administration of the Contract
3.1.3, 3.7.4, 15.2, 9.4.1, 9.5
Architect's Approvals
2.5, 3.1.3, 3.5, 3.10.2, 4.2.7
Architect's Authority to Reject Work
3.5, 4.2.6, 12.1.2, 12.2.1
Architect's Copyright
1.1.7, 1.5
Architect's Decisions
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1, 13.4.2, 15.2
Architect's Inspections
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4
Architect's Instructions
3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2
Architect's Interpretations
4.2.11, 4.2.12
Architect's Project Representative
4.2.10
Architect's Relationship with Contractor
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16, 3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2
Architect's Relationship with Subcontractors
1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3
Architect's Representations
9.4.2, 9.5.1, 9.10.1
Architect's Site Visits
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4
Asbestos
10.3.1
Attorneys' Fees
3.18.1, 9.6.8, 9.10.2, 10.3.3
Award of Separate Contracts
6.1.1, 6.1.2
Award of Subcontracts and Other Contracts for Portions of the Work
5.2
Basic Definitions
1.1
Bidding Requirements
1.1.1
Binding Dispute Resolution
8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5, 15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1
Bonds, Lien
7.3.4.4, 9.6.8, 9.10.2, 9.10.3
Bonds, Performance, and Payment
7.3.4.4, 9.6.7, 9.10.3, 11.1.2, 11.1.3, 11.5
Building Information Models Use and Reliance
1.8
Building Permit
3.7.1
Capitalization
1.3
Certificate of Substantial Completion
9.8.3, 9.8.4, 9.8.5

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

Certificates for Payment
4.2.1, 4.2.5, 4.2.9, 9.3.3, 9.4, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4
Certificates of Inspection, Testing or Approval
13.4.4
Certificates of Insurance
9.10.2
Change Orders
1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3, 7.1.2, 7.1.3, 7.2, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1, 9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2
Change Orders, Definition of
7.2.1
CHANGES IN THE WORK
2.2.2, 3.11, 4.2.8, 7, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1, 11.5
Claims, Definition of
15.1.1
Claims, Notice of
1.6.2, 15.1.3
CLAIMS AND DISPUTES
3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, 15, 15.4
Claims and Timely Assertion of Claims
15.4.1
Claims for Additional Cost
3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, 15.1.5
Claims for Additional Time
3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, 15.1.6
Concealed or Unknown Conditions, Claims for
3.7.4
Claims for Damages
3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3, 11.3.2, 14.2.4, 15.1.7
Claims Subject to Arbitration
15.4.1
Cleaning Up
3.15, 6.3
Commencement of the Work, Conditions Relating to
2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3, 6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, 15.1.5
Commencement of the Work, Definition of
8.1.2
Communications
3.9.1, 4.2.4
Completion, Conditions Relating to
3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1, 9.10, 12.2, 14.1.2, 15.1.2
COMPLETION, PAYMENTS AND
9
Completion, Substantial
3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2
Compliance with Laws
2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3, 15.2.8, 15.4.2, 15.4.3
Concealed or Unknown Conditions
3.7.4, 4.2.8, 8.3.1, 10.3
Conditions of the Contract
1.1.1, 6.1.1, 6.1.4
Consent, Written
3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2, 15.4.4.2
Consolidation or Joinder
15.4.4
CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
1.1.4, 6
Construction Change Directive, Definition of
7.3.1
Construction Change Directives
1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, 7.3, 9.3.1.1
Construction Schedules, Contractor's
3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
Contingent Assignment of Subcontracts
5.4, 14.2.2.2
Continuing Contract Performance
15.1.4
Contract, Definition of
1.1.2
CONTRACT, TERMINATION OR SUSPENSION OF THE
5.4.1.1, 5.4.2, 11.5, 14
Contract Administration
3.1.3, 4, 9.4, 9.5
Contract Award and Execution, Conditions Relating to
3.7.1, 3.10, 5.2, 6.1
Contract Documents, Copies Furnished and Use of
1.5.2, 2.3.6, 5.3
Contract Documents, Definition of
1.1.1
Contract Sum
2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4, 9.1, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2, 12.3, 14.2.4, 14.3.2, 15.1.4.2, 15.1.5, 15.2.5
Contract Sum, Definition of
9.1
Contract Time
1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5, 7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7, 7.3.10, 7.4, 8.1.1, 8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2, 14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5
Contract Time, Definition of
8.1.1
CONTRACTOR
3
Contractor, Definition of
3.1, 6.1.2
Contractor's Construction and Submittal Schedules
3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2
Contractor's Employees

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.3, 14.1, 14.2.1.1
Contractor's Liability Insurance
11.1
Contractor's Relationship with Separate Contractors and Owner's Forces
3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4
Contractor's Relationship with Subcontractors
1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7, 9.10.2, 11.2, 11.3, 11.4
Contractor's Relationship with the Architect
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.4, 15.1.3, 15.2.1
Contractor's Representations
3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2
Contractor's Responsibility for Those Performing the Work
3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8
Contractor's Review of Contract Documents
3.2
Contractor's Right to Stop the Work
2.2.2, 9.7
Contractor's Right to Terminate the Contract
14.1
Contractor's Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2, 9.8.3, 9.9.1, 9.10.2, 9.10.3
Contractor's Superintendent
3.9, 10.2.6
Contractor's Supervision and Construction Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4
Coordination and Correlation
1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1
Copies Furnished of Drawings and Specifications
1.5, 2.3.6, 3.11
Copyrights
1.5, 3.17
Correction of Work
2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, 12.2, 12.3, 15.1.3.1, 15.1.3.2, 15.2.1
Correlation and Intent of the Contract Documents
1.2
Cost, Definition of
7.3.4
Costs
2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2, 12.1.2, 12.2.1, 12.2.4, 13.4, 14
Cutting and Patching
3.14, 6.2.5
Damage to Construction of Owner or Separate Contractors
3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4
Damage to the Work
3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4
Damages, Claims for
3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2, 11.3, 14.2.4, 15.1.7
Damages for Delay
6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2
Date of Commencement of the Work, Definition of
8.1.2
Date of Substantial Completion, Definition of
8.1.3
Day, Definition of
8.1.4
Decisions of the Architect
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2, 14.2.2, 14.2.4, 15.1, 15.2
Decisions to Withhold Certification
9.4.1, 9.5, 9.7, 14.1.1.3
Defective or Nonconforming Work, Acceptance, Rejection and Correction of
2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1
Definitions
1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1, 6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1
Delays and Extensions of Time
3.2, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5
Digital Data Use and Transmission
1.7
Disputes
6.3, 7.3.9, 15.1, 15.2
Documents and Samples at the Site
3.11
Drawings, Definition of
1.1.5
Drawings and Specifications, Use and Ownership of
3.11
Effective Date of Insurance
8.2.2
Emergencies
10.4, 14.1.1.2, 15.1.5
Employees, Contractor's
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.3, 14.1, 14.2.1.1
Equipment, Labor, or Materials
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2
Execution and Progress of the Work
1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4
Extensions of Time
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2, 10.4, 14.3, 15.1.6, 15.2.5

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

Failure of Payment
9.5.1.3, 9.7, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2
Faulty Work
(See Defective or Nonconforming Work)
Final Completion and Final Payment
4.2.1, 4.2.9, 9.8.2, 9.10, 12.3, 14.2.4, 14.4.3
Financial Arrangements, Owner's
2.2.1, 13.2.2, 14.1.1.4
GENERAL PROVISIONS
1
Governing Law
13.1
Guarantees (See Warranty)
Hazardous Materials and Substances
10.2.4, 10.3
Identification of Subcontractors and Suppliers
5.2.1
Indemnification
3.17, 3.18, 9.6.8, 9.10.2, 10.3.3, 11.3
Information and Services Required of the Owner
2.1.2, 2.2, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5,
9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2,
14.1.1.4, 14.1.4, 15.1.4
Initial Decision
15.2
Initial Decision Maker, Definition of
1.1.8
Initial Decision Maker, Decisions
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5
Initial Decision Maker, Extent of Authority
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5
Injury or Damage to Person or Property
10.2.8, 10.4
Inspections
3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,
9.9.2, 9.10.1, 12.2.1, 13.4
Instructions to Bidders
1.1.1
Instructions to the Contractor
3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2
Instruments of Service, Definition of
1.1.7
Insurance
6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5,
11
Insurance, Notice of Cancellation or Expiration
11.1.4, 11.2.3
Insurance, Contractor's Liability
11.1
Insurance, Effective Date of
8.2.2, 14.4.2
Insurance, Owner's Liability
11.2
Insurance, Property
10.2.5, 11.2, 11.4, 11.5
Insurance, Stored Materials
9.3.2
INSURANCE AND BONDS
11
Insurance Companies, Consent to Partial Occupancy
9.9.1
Insured loss, Adjustment and Settlement of
11.5
Intent of the Contract Documents
1.2.1, 4.2.7, 4.2.12, 4.2.13
Interest
13.5
Interpretation
1.1.8, 1.2.3, 1.4, 4.1.1, 5.1, 6.1.2, 15.1.1
Interpretations, Written
4.2.11, 4.2.12
Judgment on Final Award
15.4.2
Labor and Materials, Equipment
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1,
10.2.4, 14.2.1.1, 14.2.1.2
Labor Disputes
8.3.1
Laws and Regulations
1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4,
9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8,
15.4
Liens
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8
Limitations, Statutes of
12.2.5, 15.1.2, 15.4.1.1
Limitations of Liability
3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6,
4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3,
11.3, 12.2.5, 13.3.1
Limitations of Time
2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7,
5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,
9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15,
15.1.2, 15.1.3, 15.1.5
Materials, Hazardous
10.2.4, 10.3
Materials, Labor, Equipment and
1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2,
10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2
Means, Methods, Techniques, Sequences and
Procedures of Construction
3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2
Mechanic's Lien
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8
Mediation
8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, 15.3, 15.4.1,
15.4.1.1
Minor Changes in the Work
1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, 7.4
MISCELLANEOUS PROVISIONS
13

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

Modifications, Definition of
1.1.1
Modifications to the Contract
1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7, 10.3.2
Mutual Responsibility
6.2
Nonconforming Work, Acceptance of
9.6.6, 9.9.3, 12.3
Nonconforming Work, Rejection and Correction of
2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4, 12.2
Notice
1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2., 2.2.3, 2.2.4, 2.5, 3.2.4, 3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4, 8.2.2 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1, 13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5, 15.1.6, 15.4.1
Notice of Cancellation or Expiration of Insurance
11.1.4, 11.2.3
Notice of Claims
1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, 15.1.3, 15.1.5, 15.1.6, 15.2.8, 15.3.2, 15.4.1
Notice of Testing and Inspections
13.4.1, 13.4.2
Observations, Contractor's
3.2, 3.7.4
Occupancy
2.3.1, 9.6.6, 9.8
Orders, Written
1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2, 14.3.1
OWNER
2
Owner, Definition of
2.1.1
Owner, Evidence of Financial Arrangements
2.2, 13.2.2, 14.1.1.4
Owner, Information and Services Required of the
2.1.2, 2.2, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4
Owner's Authority
1.5, 2.1.1, 2.3.32.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2, 4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2, 10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4, 15.2.7
Owner's Insurance
11.2
Owner's Relationship with Subcontractors
1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2
Owner's Right to Carry Out the Work
2.5, 14.2.2
Owner's Right to Clean Up
6.3
Owner's Right to Perform Construction and to Award Separate Contracts
6.1
Owner's Right to Stop the Work
2.4
Owner's Right to Suspend the Work
14.3
Owner's Right to Terminate the Contract
14.2, 14.4
Ownership and Use of Drawings, Specifications and Other Instruments of Service
1.1.1, 1.1.6, 1.1.7, 1.5, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12, 5.3
Partial Occupancy or Use
9.6.6, 9.9
Patching, Cutting and
3.14, 6.2.5
Patents
3.17
Payment, Applications for
4.2.5, 7.3.9, 9.2, 9.3, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1, 14.2.3, 14.2.4, 14.4.3
Payment, Certificates for
4.2.5, 4.2.9, 9.3.3, 9.4, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4
Payment, Failure of
9.5.1.3, 9.7, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2
Payment, Final
4.2.1, 4.2.9, 9.10, 12.3, 14.2.4, 14.4.3
Payment Bond, Performance Bond and
7.3.4.4, 9.6.7, 9.10.3, 11.1.2
Payments, Progress
9.3, 9.6, 9.8.5, 9.10.3, 14.2.3, 15.1.4
PAYMENTS AND COMPLETION
9
Payments to Subcontractors
5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2
PCB
10.3.1
Performance Bond and Payment Bond
7.3.4.4, 9.6.7, 9.10.3, 11.1.2
Permits, Fees, Notices and Compliance with Laws
2.3.1, 3.7, 3.13, 7.3.4.4, 10.2.2
PERSONS AND PROPERTY, PROTECTION OF
10
Polychlorinated Biphenyl
10.3.1
Product Data, Definition of
3.12.2
Product Data and Samples, Shop Drawings
3.11, 3.12, 4.2.7
Progress and Completion
4.2.2, 8.2, 9.8, 9.9.1, 14.1.4, 15.1.4
Progress Payments
9.3, 9.6, 9.8.5, 9.10.3, 14.2.3, 15.1.4
Project, Definition of
1.1.4
Project Representatives

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

4.2.10
Property Insurance
10.2.5, 11.2
Proposal Requirements
1.1.1
PROTECTION OF PERSONS AND PROPERTY
10
Regulations and Laws
1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8, 15.4
Rejection of Work
4.2.6, 12.2.1
Releases and Waivers of Liens
9.3.1, 9.10.2
Representations
3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1
Representatives
2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1
Responsibility for Those Performing the Work
3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10
Retainage
9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3
Review of Contract Documents and Field Conditions by Contractor
3.2, 3.12.7, 6.1.3
Review of Contractor's Submittals by Owner and Architect
3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2
Review of Shop Drawings, Product Data and Samples by Contractor
3.12
Rights and Remedies
1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1, 6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2, 12.2.4, 13.3, 14, 15.4
Royalties, Patents and Copyrights
3.17
Rules and Notices for Arbitration
15.4.1
Safety of Persons and Property
10.2, 10.4
Safety Precautions and Programs
3.3.1, 4.2.2, 4.2.7, 5.3, 10.1, 10.2, 10.4
Samples, Definition of
3.12.3
Samples, Shop Drawings, Product Data and
3.11, 3.12, 4.2.7
Samples at the Site, Documents and
3.11
Schedule of Values
9.2, 9.3.1
Schedules, Construction
3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
Separate Contracts and Contractors
1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2
Separate Contractors, Definition of
6.1.1
Shop Drawings, Definition of
3.12.1
Shop Drawings, Product Data and Samples
3.11, 3.12, 4.2.7
Site, Use of
3.13, 6.1.1, 6.2.1
Site Inspections
3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4
Site Visits, Architect's
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4
Special Inspections and Testing
4.2.6, 12.2.1, 13.4
Specifications, Definition of
1.1.6
Specifications
1.1.1, 1.1.6, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14
Statute of Limitations
15.1.2, 15.4.1.1
Stopping the Work
2.2.2, 2.4, 9.7, 10.3, 14.1
Stored Materials
6.2.1, 9.3.2, 10.2.1.2, 10.2.4
Subcontractor, Definition of
5.1.1
SUBCONTRACTORS
5
Subcontractors, Work by
1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2, 9.6.7
Subcontractual Relations
5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1
Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3, 9.8, 9.9.1, 9.10.2, 9.10.3
Submittal Schedule
3.10.2, 3.12.5, 4.2.7
Subrogation, Waivers of
6.1.1, 11.3
Substances, Hazardous
10.3
Substantial Completion
4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2
Substantial Completion, Definition of
9.8.1
Substitution of Subcontractors
5.2.3, 5.2.4
Substitution of Architect
2.3.3
Substitutions of Materials
3.4.2, 3.5, 7.3.8
Sub-subcontractor, Definition of
5.1.2
Subsurface Conditions
3.7.4
Successors and Assigns

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

13.2
Superintendent
3.9, 10.2.6
Supervision and Construction Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4
Suppliers
1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6, 9.10.5, 14.2.1
Surety
5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2, 15.2.7
Surety, Consent of
9.8.5, 9.10.2, 9.10.3
Surveys
1.1.7, 2.3.4
Suspension by the Owner for Convenience
14.3
Suspension of the Work
3.7.5, 5.4.2, 14.3
Suspension or Termination of the Contract
5.4.1.1, 14
Taxes
3.6, 3.8.2.1, 7.3.4.4
Termination by the Contractor
14.1, 15.1.7
Termination by the Owner for Cause
5.4.1.1, 14.2, 15.1.7
Termination by the Owner for Convenience
14.4
Termination of the Architect
2.3.3
Termination of the Contractor Employment
14.2.2

TERMINATION OR SUSPENSION OF THE CONTRACT
14
Tests and Inspections
3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 10.3.2, 12.2.1, 13.4
TIME
8
Time, Delays and Extensions of
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5
Time Limits
2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2, 5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15.1.2, 15.1.3, 15.4
Time Limits on Claims
3.7.4, 10.2.8, 15.1.2, 15.1.3
Title to Work
9.3.2, 9.3.3
UNCOVERING AND CORRECTION OF WORK
12
Uncovering of Work
12.1
Unforeseen Conditions, Concealed or Unknown
3.7.4, 8.3.1, 10.3
Unit Prices
7.3.3.2, 9.1.2
Use of Documents
1.1.1, 1.5, 2.3.6, 3.12.6, 5.3
Use of Site
3.13, 6.1.1, 6.2.1
Values, Schedule of
9.2, 9.3.1
Waiver of Claims by the Architect
13.3.2
Waiver of Claims by the Contractor
9.10.5, 13.3.2, 15.1.7
Waiver of Claims by the Owner
9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, 15.1.7
Waiver of Consequential Damages
14.2.4, 15.1.7
Waiver of Liens
9.3, 9.10.2, 9.10.4
Waivers of Subrogation
6.1.1, 11.3
Warranty
3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2, 15.1.2
Weather Delays
8.3, 15.1.6.2
Work, Definition of
1.1.3
Written Consent
1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3, 13.2, 13.3.2, 15.4.4.2
Written Interpretations
4.2.11, 4.2.12
Written Orders
1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

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 a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's 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 the Owner and by Separate Contractors.

§ 1.1.5 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.

§ 1.1.6 The Specifications

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

§ 1.1.7 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.

§ 1.1.8 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.

§ 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 consistent with the Contract

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

Documents and reasonably inferable from them as being necessary to produce the indicated results. Notwithstanding such performance, in case of a conflict, disagreement, or ambiguity, provide the better quality of Work. In case of a conflict, disagreement, or ambiguity, provide the greater quantity of Work.

§ 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.

1.2.1.2 Plumbing, Mechanical, Fire Protection and Electrical drawings are diagrammatic, showing general locations and arrangements of piping, wiring, equipment, security and technology, and specialties; not necessarily showing all required offsets, conditions and appurtenances required for maximum practical accessibility for operation, maintenance and clearances. Coordinate this Work in order to achieve the required and intended Work and notify the Architect immediately of conditions which do not comply or will not allow for this condition.

§ 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 Unless otherwise required by the Owner and Architect Agreement, 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, 1.8, and 1.9 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 registered 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

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

certified or registered mail, or by courier providing proof of delivery, including signature of receiver of such notices.

§ 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 shall use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data, should such Exhibit be included in the Agreement.

§ 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.

§ 1.9 If such Exhibits are not included in the Agreement, the Architect may, with the concurrence of the Owner, furnish to the Contractor versions of the Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Section 1.1.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers. The Contractor shall not transfer or reuse Instruments of Service in electronic or machine readable form without the prior written consent of the Architect.

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. The Architect does 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.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 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, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 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 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 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.

§ 2.3.5 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.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one electronic copy of the Drawings, Specifications, and Addenda issued, **for the purposes of making reproductions pursuant to Section 1.5.2.**

§ 2.3.6.1 At the Architect's sole discretion, selected electronic (CAD) Drawing files may be made available for use by the Contractor after execution of the Contract for Construction, with the exception of civil grading and layout plans, if authorized by the civil consultant. Such electronic files are not part of the Contract Documents. If available, the Architect shall release them to the Contractor subject to the terms and conditions established by the Architect, to which the Contractor must agree without exception prior to release of the electronic files. Refer to **www.moseleyarchitects.com** for the Architect's current Request for Electronic (CAD) Files form, which defines the applicable terms and conditions.

§ 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.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 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. Amounts charged to the Contractor may, pursuant to Section 9.5.1, 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 Architect's 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 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 Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.1.4 During the performance of this Contract, the Contractor will include the provisions of the foregoing Sections 3.1.4.1 and 3.1.4.2 in every Subcontract or purchase order of over ten thousand dollars ($10,000.), so that the provisions will be binding upon each Subcontractor or vendor; and furthermore, the Contractor agrees as follows:

.1 The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin, except where religion, sex or national origin is a bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this non-discrimination clause.

.2 The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such Contractor is an equal opportunity employer.

.3 Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting requirements of this section.

.4 The Contractor does not, and shall not during the performance of this Contract, knowingly employ an unauthorized alien as defined in the Federal Immigration Reform and Control Act of 1986.

.5 Contractor hereby represents it is organized as a stock or non-stock corporation, limited liability company, business trust, or limited partnership or registered as a registered limited liability partnership and is authorized to transact business in the jurisdiction where the Project is located as a domestic or foreign business entity if so required by Title 13.1 or Title 50 or as otherwise required by law.

§ 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, 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

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the 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 Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require. 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.

§ 3.2.4 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.

§ 3.2.5 The Owner shall deduct from the Contract Sum amounts paid to the Architect for the Architect to evaluate and respond to the Contractor's requests for information, where such information was available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior correspondence or documentation.

§ 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 appropriate, the Contractor shall give timely notice to the Owner and 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. Unless the Architect objects to the Contractor's proposed alternative in writing, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 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 Work 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 found to be acceptable 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

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

only with the consent of the Owner, after review by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.2.1 After the Contract has been executed, the Owner and the Architect will consider a formal request for substitution in lieu of those required by the Contract Documents only under and in addition to, the conditions set forth in the Contract Documents. By making requests for substitutions, the Contractor:

.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to requirements of the Contract Documents;

.2 represents that the Contractor will provide the same warranty for the substitution that the Contractor is required to provide under the Contract Documents;

.3 certifies that the cost data presented is complete and includes all related costs under this Contract including the Architect's redesign costs, and waives all claims for additional costs and time related to the substitution which subsequently become apparent; and

.4 will coordinate and perform the installation of the accepted substitute, making such changes to the Work as may be required for the Work to be complete in all respects.

§ 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.

§ 3.4.4 The Owner shall deduct from the Contract Sum amounts paid to the Architect for the Architect to review the Contractor's proposed substitutions, to make agreed-upon changes in the Instruments of Service, including the Contract Documents, and to provide additional construction phase services made necessary by the Owner's acceptance of such substitutions.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner 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 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 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.

§ 3.6.1 The 179D tax deduction incentivizes building owners and designers for designing energy-efficient building systems, including lighting, HVAC, and building envelope components. Since government entities do not pay taxes, this deduction is not available to the Owner. Current tax code allows for this deduction to be allocated to the Architect by the Owner on eligible projects to help incentivize energy-efficient building design.

§ 3.6.2 The Contractor recognizes that the Architect is the only entity eligible to pursue such allocations in accordance with 26 U.S. Code §179D, which reads in part, "The allocation of the deduction [is] to the person primarily responsible for designing the property in lieu of the owner of such property." The Contractor further acknowledges the Architect as the primary designer of the project for the purposes of 179D and agrees not to pursue the deduction or to request any portion thereof from the Architect or Owner.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as 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.

§ 3.7.1.1 Unless otherwise provided in the Contract Documents, the Contractor is responsible for obtaining utilities for the Project and providing the Work relating to Project utilities as indicated. Responsibility for payment of fees associated with providing utilities to the Project shall be as follows:

.1 Any fees assessed by entities for providing permanent utilities to the Project shall be paid directly to the utility entities by Owner. These include "tap fees" and "electrical connection and service fee." Contractor shall coordinate the permanent utilities and the entity's related work to comply with the construction schedule.

.2 Any fees assessed by entities for providing temporary utilities to the Project for use by Contractor during construction of the Project shall be paid by the Contractor. The Contractor's payment of fees for temporary utilities shall be included in the Base Bid and Contract Sum and will not be reimbursed by the Owner.

§ 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 (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 and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly review such conditions and, if the Architect 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 determine that an equitable adjustment should be made in the Contract Sum or Contract Time, or both. If the Architect 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 and Contractor, stating the reasons. If either party disputes the Architect's determination that 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 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;

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

.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. The Contractor shall identify the date for Owner's selection on the critical path of the Contractor's Construction Schedule and provide the Owner a minimum of two weeks notice before this date.

§ 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 of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Owner may notify the Contractor, stating whether the Owner (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Owner 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 has made reasonable and timely objection. The Contractor shall not change the superintendent or project manager without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 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 a Contractor's construction schedule for the Work. Unless otherwise required by the Contract Documents; the schedule shall contain details 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 the Substantial Completion date and final completion date indicated in the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 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 in accordance with section 3.12. Unless otherwise required by the Contract Documents, the submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the accepted 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 perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 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 Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 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 is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is 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 Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule accepted by the Architect or, in the absence of an accepted submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner 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 accepted by the Architect.

§ 3.12.8 The Work shall be in accordance with accepted submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's acceptance of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written acceptance to the specific deviation in accordance with 3.12.9 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 acceptance thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing on a cover letter attached to the original or on the case of a resubmittal, on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to all revisions or deviations other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's acceptance of a resubmission shall not apply to such revisions or deviations.

§ 3.12.10 The Contractor shall not be required (delegated design) 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 such delegated 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 provide 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

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, licensed in the state where the Project is located, 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 and the Architect 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 provided 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 take 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.

§ 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 Architect at the time and in the form specified by the Architect.

§ 3.12.11 The Architect's review of Contractor's submittals will be limited to examination of an initial submittal and one (1) resubmittals. The Architect's review of additional resubmittals will be made only with the consent of the Owner after notification by the Architect. The Owner shall to deduct from the Contract Sum amounts paid to the Architect for evaluation of such additional resubmittals.

§ 3.13 Use of Site

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.

§ 3.14 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 or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, 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 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 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 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 or Architect. However, if an infringement of a

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

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.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, 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.

§ 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

§ 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. Such terms as 'Architect-Engineer,' 'Engineer,' and 'A-E,' if used in these Contract Documents, is intended to mean the Architect and its consultants unless otherwise intended by the context or usage of such terms. Such terms do not mean or include any design professional of the Contractor, Subcontractor, or Owner.

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

§ 4.1.3 Subject to the standard of care for applying professional judgment to information used or relied upon, Architect and its Consultants may use and rely upon design elements, technical standards, test results, and all other information ordinarily or customarily furnished or published by others, including, but not limited to, specialty contractors, manufacturers, fabricators, and suppliers.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The 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 as 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 general compliance 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. The 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.

§ 4.2.2.1 The Contractor shall reimburse the Owner for compensation paid to the Architect for additional site visits made necessary by the fault, neglect or request of the Contractor.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and endeavor to report to the Owner (1) known deviations from the

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) known defects and deficiencies in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor 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 Contractor 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 Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and take appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for general conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor. The 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 Architect's review shall not constitute acceptance of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's acceptance of a specific item shall not indicate acceptance of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will review and make determinations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 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 Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 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

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

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 rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests 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 a Separate Contractor or the subcontractors of a Separate Contractor.

§ 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 submit to the Owner and Architect the persons or entities proposed for each principal portion of the Work (list of proposed subcontractors), including those who are to furnish materials or equipment fabricated to a special design no later than two days prior to the date of the Pre-construction Conference. Include Contractor's License number and Class for each proposed Subcontractor. Within 14 days of receipt of the information, the Owner may notify the Contractor whether the Owner (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Owner to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner 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 has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner 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 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 and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner 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

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

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 complete 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 shall similarly make available copies of the complete Contract Documents 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 and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. 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.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 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 and Separate 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.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Owner and Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Owner and Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's 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 Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor 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 a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 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 or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor 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, 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 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.

(Paragraph Deleted)

§
(Paragraph Deleted)

7.1.1.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect 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.

§ 7.1.1.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order. A Construction Change Directive is a written order prepared by the Architect and signed by the Owner 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.

§
7.1.1.2.1 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;

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

.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 7.2.

§
(Paragraphs Deleted)

7.1.1.2.2 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect 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.

§ 7.1.1.2.3 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.

§
7.1.1.2.4 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 Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional opinion, to be reasonably justified. The Architect's 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.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner 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.

§ 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.

7.1.4 If a change in the Work results in an adjustment to the Contract Sum, the adjustment (increase or decrease) shall be based on the following, unless noted otherwise:

.1 Material quantities and unit prices (separated into trades; include sales tax).
.2 Labor costs (raw cost).
.3 Labor burden, applied to labor only, including but not limited to, worker's compensation and public liability, social security tax, old age and unemployment insurance, union welfare fund and fringe benefits. Contractor shall be required to substantiate the labor burden percentage applied to any change in contract amount. Labor burden percentage shall not exceed 30% in any case.
.4 Construction equipment cost.
.5 Overhead and profit combined (on Claims for net increase only), as defined in Section 7.3.11.
.6 Cost of Premiums for Bonds (for Contractor only). Evidence of additional premium for bond shall be submitted with Claim.
.7 Extended Overhead Costs (if applicable) which shall be established by pro-rating the value of supervision, temporary facility, and General Conditions and all other direct and indirect costs of Contractor included in the Contract Sum over the number of days included in the Contract Time.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect 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. In Sections 7.2 and 7.2.1, the amount for overhead and profit combined, included in the total cost to the Owner,

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

shall be based on the following schedule:

.1 for the Contractor, for Work performed by the Contractor's own forces, 15 percent of the cost.

.2 for the Contractor, for Work performed by the Contractor's Subcontractors, 5 percent of the amount due the Subcontractors.

.3 for each Subcontractor involved, for Work performed by that Subcontractor's own forces, 15 percent of the cost.

.4 for each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractor, 5 percent of the amount due the Sub-subcontractor.

.5 cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.2.

.6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs in the manner prescribed above. Where major cost items are changes to Subcontracts, they shall be itemized also. In no case will a change involving over $500.00 be approved without such itemization.

§ 7.4 Minor Changes in the Work

In the Architect's opinion, 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 Architect 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 Architect 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 or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unavoidable casualties, adverse weather conditions documented in accordance with Section 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 determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine and the Owner approves.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 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 Architect 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 Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by 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 ten days before the date established for each progress payment, the Contractor shall submit to the Architect 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 or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

(Paragraphs Deleted)

§ 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.

§ 9.3.2.1 Contractor shall provide invoices, package slips, or other form of supporting data for materials stored on-site claimed on the progress payment, unless it can be verified through on-site observations. Maintain concise bill of materials and label materials stored on-site for ready identification and verification.

§ 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 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 The Architect will, unless otherwise agreed upon, within seven working days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

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 Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, 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 general conformance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for general 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 Architect. However, the issuance of a Certificate for Payment is not a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality 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 Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The 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 previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from 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;
- **.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 withholds certification for payment under Section 9.5.1.3, 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 Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a 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 Architect.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 9.6.1.1 The Owner may withhold payments to the Contractor notwithstanding the Architect's certification if it is necessary, in the Owner's opinion, to do so to protect the Owner from loss due to any of the reasons set forth in Sections 9.5.1.1 through 9.5.1.7.

9.6.2 Payment of Subcontractors

§ 9.6.2.1 The Contractor shall pay each Subcontractor, no later than seven working 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.

9.6.2.2 Within seven (7) working days after receipt of amounts paid to the Contractor by the Owner for Work performed under this Agreement, the Contractor shall do one of the following:

a. Pay each Subcontractor for the proportional share of the total payment received from the Owner attributable to the Work performed by the respective Subcontractor under This Agreement; or

b. Notify the Owner and Architect, and Subcontractor, in writing, of the Contractor's intention to withhold all or part of the Subcontractor's payment with the reason for nonpayment.

9.6.2.3 The Contractor shall pay interest to each Subcontractor on all amounts owed by the Contractor that remain unpaid after seven (7) days following receipt by the Contractor of payment from the Owner for Work performed by the affected Subcontractor under this Agreement, except for amounts withheld as allowed in Section 9.6.8.1. Unless otherwise provided under the terms of this Agreement, for purposes solely of these prompt payment provisions, interest shall accrue at the rate of one percent (1%) per month.

9.6.2.4 In each Subcontract, the Contractor shall include a provision requiring each Subcontractor to include or otherwise be subject to the same payment and interest requirements with respect to each lower-tier Subcontractor (Sub-Subcontractor).

9.6.2.5 The Contractor's obligation to pay interest to a Subcontractor pursuant to the prompt payment provisions is not an obligation of the Owner, and no modification shall be made to this Agreement and no cost reimbursements claim shall be made for the purpose of providing reimbursement by Owner for such interest charge.

§ 9.6.3 The Architect 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 Architect and Owner 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 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 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.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 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, unless otherwise agreed upon, the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven working days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven working days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional working days' notice to the Owner 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 that 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 prepare and submit to the Architect a comprehensive list of items to be completed or corrected. 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 Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect discloses any item, whether or not included on the Contractor's 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 to determine Substantial Completion.

9.8.3.1 The Architect will provide no more than one (1) inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner shall deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare 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,

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

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 shall 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.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly review 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 receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in general compliance 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 Architect's final 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.

9.10.1.1 The Architect will provide no more than one (1) inspections to determine whether the Work or a designated portion thereof has attained final completion in accordance with the Contract Documents. The Owner shall deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect for the record (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 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 Architect so confirms, the Owner shall, upon application by the Contractor and certification by the 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 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;

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

.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.

§ 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; and
.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.

§ 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.

§ 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 and 10.2.1.3 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 and 10.2.1.3. 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 or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either 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.

§ 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

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

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 and Substances

§ 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 and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner may 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 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 will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If the Contractor has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor has 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.

(Paragraph Deleted)

§ 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 Liability Insurance

§11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in Virginia such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed 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 directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

1. Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

2. Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
4. Claims for damages insured by usual personal injury liability coverage;
5. Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
6. Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
7. Claims for bodily injury or property damage arising out of completed operations; and
8. Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§
11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§11.2 OWNER'S LIABILITY INSURANCE The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.
§11.3 PROPERTY INSURANCE
§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in Virginia, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 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, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 WAIVERS OF SUBROGATION 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, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, 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

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

(Paragraphs Deleted)

§ 11.3.8 A loss insured under the Owner's property insurance 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 requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 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.

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 Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's review 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 Architect has not specifically requested to review prior to its being covered, the 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

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense without change to the contract time.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or Owner 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 Architect's services and expenses made necessary thereby, shall be at the Contractor's expense without change to the contract time.

§ 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 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.

§ 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.

12.2.2.4 If required by the Owner and the Architect and, upon request by the Owner and prior to the expiration of one year from the date of Substantial Completion, the Architect will conduct and the Contractor shall attend a meeting with the Owner to review the facility operations and performance and the Work.

§ 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 or Separate 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.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 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, 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 Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded.

§ 13.4.2 If the 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 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 Architect of when and where tests and inspections are to be made so that the 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 Architect's services and expenses, shall be at the Contractor's expense without change to contract time.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and submitted to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so in a timely manner 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.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

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 Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, 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 working days' notice to the Owner 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.

§ 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 or entities 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 working days' notice to the Owner and the 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, and upon determination 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 Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

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 be determined by the Initial Decision Maker, upon application, 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 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 the 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

.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 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.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 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, Contract Time, or both 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.

§ 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. Time extensions from adverse weather conditions shall not entitle the Contractor to "extended overhead" recovery.

§ 15.1.6.2.1 Weather data utilized to support claims for adverse weather conditions shall be that obtained from the National Oceanic and Atmospheric Administration (NOAA) for the nearest weather station to the Project. Adverse weather conditions are defined as measurable precipitation (MP) of 0.1 " or more, or 1.0" or more of snow or ice pellets, or freezing temperature (FT) for a day (24 hours) when the temperature remains at 32 degrees Fahrenheit or below. Only measurable precipitation (MP) or freezing temperature (FT) shall be permitted to be claimed for any one calendar day. Time extensions for adverse weather conditions shall be cumulative over the duration of the Project time and claims shall not be permitted for days for drying out of rain-soaked soil, snow accumulation, or similar weather-related conditions or resulting Project conditions.

.1 The Contractor agrees that it shall not be entitled to a time extension for normal inclement weather (weather conditions other than "adverse weather conditions") which could have been expected at the Project locale due to precipitation or temperature, based upon actual data from the National Oceanic and Atmospheric Administration (NOAA) for the locality closest to the Project for a five-year period preceding the date of the Contract. The Contractor acknowledges and warrants that in making its proposal or bid and Construction Schedule for the Work, it gave due care and consideration to this expected number of calendar days of inclement weather for the locale of the Project and allowed for the impact of normal inclement weather on subsequent Work. During the time of performance, should the expected number of calendar days of normal inclement weather for the locale of the Project be less than originally anticipated by the Contractor and the Owner, at the time of contracting, those days not so affected by normal inclement weather shall be considered float time in the Construction Schedule.

.2 The Contractor agrees that the measure of adverse weather conditions due to MP or FT during the period covered by this Contract shall be the number of days where adverse weather conditions comply with the weather data referenced in subparagraph 15.1.6.2.1.

.3 Extensions of time will be made only for days in which abnormal adverse weather criteria cited in subparagraph 15.1.6.2.1 occur.

.4 If the total calendar days lost due to adverse weather conditions, from the start of the Work at the Project by the Contractor until the principal portions of the Work are enclosed, exceeds the total number of days to be expected to

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

be lost for the same time period, a time extension, if granted, shall only be for the number of calendar days needed to equal the excess number of calendar days lost to such adverse weather conditions.

§ 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 working days after the Claim has been referred to the Initial Decision Maker, subject to Section 15.2.6 the party asserting the Claim may demand mediation without a decision having been rendered. 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 working 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 working 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 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 at any time, subject to the terms of Section 15.2.6.1.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

§ 15.2.6.1 Either party may, within 30 working days from the date of receipt of an initial decision, or if no decision has been rendered in accordance with Section 15.2.1, 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 within 30 working days after 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 working days from the date of filing, unless stayed for a longer period by agreement of the parties or court order..

§ 15.3.3 Either party may, within 30 working days from the date that mediation has been concluded without resolution of the dispute or 60 working 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 working days after written 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.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 11:42:49 ET on 02/29/2024 under Order No.4104248195 which expires on 01/11/2025, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.
User Notes: (3B9ADA46)

SECTION 000750 SUPPLEMENTARY GENERAL CONDITIONS

The following supplements modify, change, delete from or add to the "**General Conditions of the Contract for Construction" AIA Document A201, 2017 Edition that was supplied with the invitation to bid**. Where any article of the General Conditions is modified or any paragraph, subparagraph or clause thereof is modified or deleted by these Supplementary General Conditions, the unaltered provisions of the Article, Paragraph or Subparagraph shall remain in effect.

The General Conditions of the Contract for Construction may also be supplemented elsewhere in the Contract Documents.

ARTICLE 1 - GENERAL PROVISIONS

Paragraph 1.1 - Basic Definitions

Subparagraph 1.1.1 – The Contract Documents

DELETE the first sentence of Subparagraph 1.1.1 in its entirety and, in lieu thereof, substitute the following:

[*Substitute:*] The Contract Documents consist of documents enumerated in the Agreement between Owner and Contractor (hereinafter the Agreement) and also include of the Copyright, the Advertisement for Bids, Instructions to Bidders (AIA Document A701), Supplementary Instructions to Bidders, Bid Forms, Contractor's Qualification Statement (AIA Document A305), Non-Collusion Affidavit of Contractor, Standard Form of Agreement Between Owner and Contractor (AIA Document A101), Employment Verification Act, Affidavit Accepting Provisions of any applicable, Bid Bond, Performance & Payment Bonds, Conditions of the Contract (General, Supplementary and Special), City Of Staunton / VPPA Project Requirements / Federal Requirements (Section 000515), Employment Verification Act Provisions (Section 000516), List of Drawings, the Drawings, Specifications, all Addenda issued prior to execution of the Contract and all modifications thereto. Whenever used in a Contract Document, the term "Contract" or "Agreement" includes all exhibits to the Contract or Agreement.

DELETE the last sentence of Subparagraph 1.1.1 in its entirety.

Subparagraph 1.1.2 – The Contract

ADD the following to the end of the paragraph:

[*Add:*] "Each of the signatories below warrants and represents that he or she is authorized to bind the party on behalf of whom he or she is signing."

Subparagraph 1.1.3 – The Work

ADD the following to the end of the first sentence:

[*Add:*] "including any subcontractor's and sub-subcontractor's work and suppliers or any other entity for which Contractor is responsible and whether on or off the site of the Project."

Subparagraph 1.1.5 – The Drawings

ADD the following to the end of Subparagraph 1.1.5:

[*Add:*] "and shop drawings."

ADD the following new Subparagraphs:

1.1.9 The term "product" includes materials, systems and equipment.

1.1.10 The term "provide" includes furnishing and installing a product, complete in place, operating, tested and approved.

1.1.11 The term "building code" and the term "code" refer to regulations of governmental agencies having jurisdiction.

1.1.12 The terms "approved", "required" and "as directed" refer to and indicate the work or materials that may be approved, required or directed by Architect acting as the agent of Owner.

1.1.13 The term "similar" means in its general sense and not necessarily identical.

1.1.14 The terms "shown", "indicated", "detailed", "noted", "scheduled" and terms of similar import refer to requirements contained in the Contract Documents.

1.1.15 The terms "cost," "expense," or "fee" mean any amount paid or charged for something.

1.1.16 The term "including" also means including but not limited to the particular listing or description.

Paragraph 1.2 - Correlation and Intent of the Contract Documents

ADD the following new Subparagraphs:

1.2.4 Computed dimensions shall take precedence over scale dimensions, and large scale drawings shall take precedence over small scale drawings.

1.2.5 Anything shown on the Drawings and not mentioned in the Specifications or mentioned in the Specifications and not shown on the Drawings shall have the same effect as if shown or mentioned respectively in both. Any work shown on one Drawing shall be construed to be shown in all Drawings, and Contractor shall coordinate the Work and Drawings to conform to the requirements of the Contract Documents.

1.2.6 In the event of conflict between different provisions in the Contract Documents, the provision calling for the higher quality or greater benefit to Owner shall prevail, unless Owner accepts in writing the provision calling for a lower quality or lesser benefit.

1.2.7 If any portion of the Contract Documents shall be in conflict with any other portion, after the application of the rules of interpretation set forth in this Paragraph 1.2, the various documents comprising the Contract Documents shall govern in the order of precedence as herein set forth according to their latest date of execution: (a) Change Orders submitted, processed and approved in accordance with applicable procedure; (b) written

amendment to the various agreements (including but not limited to the Agreement) entered into or executed by Owner; (c) the various agreements entered into and executed by Owner, including but not limited to the Agreement (as modified by any Addenda thereto); (d) Addenda; (e) Supplementary Conditions (including Section 000515) (f) General Conditions; (g) Division 1 Specifications; (h) Instructions to Bidders; (i) Advertisement for Bids; (j) Bid Form; and (k) Drawings and Specifications. In the event of an inconsistency between the Specifications and Drawings, the interpretation as determined by Architect shall prevail subject to Subparagraph 1.2.5 above; as between large scale drawings and small-scale drawings, the large scale drawings shall take precedence. Specifications having greater detail or specificity take priority over specifications of lesser detail or specificity and detail takes precedence over general drawings.

Paragraph 1.5 - Ownership and Use of Drawings, Specifications and Other Instruments of Service

ADD the following new Subparagraphs:

1.5.3 All reports, plans, specifications and computer files relating to this project (hereinafter the Instruments of Service) are the property of Moseley Architects P.C.. Moseley Architects P.C. retains all common law, statute and other reserved rights including the copyright thereto.

1.5.4 Except as provided in Section 000101, Sub-subparagraph 3.1.4.1, reproduction of the material herein or substantial use without written permission of Moseley Architects P.C. violates the copyright laws of the United States and will be subject to legal prosecution.

Paragraph 1.6 – Notice
Subparagraph 1.6.1

ADD "reputable overnight delivery service" to the list of notice methods in Subparagraph 1.6.1.

DELETE the following from the end of the subparagraph and, in lieu thereof, SUBSTITUTE it as follows:

[*Delete:*] "if a method for electronic transmission is set forth in the Agreement."

[*Substitute:*] ", if such electronic transmission is actually received by the individual for which it was intended. In addition, notice to the Contractor may be in the form of meeting minutes."

ADD the following new sentence to the end of Subparagraph 1.6.1:

[*Add:*] Notice by mail shall be effective three (3) days after deposit in the mail, unless notice is received earlier.

Paragraph 1.7 – Digital Data Use and Transmission

DELETE Paragraph 1.7 in its entirety, and in lieu thereof, replace it with the following:

[*Replace*] "If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing

such transmission, unless otherwise already provided in the Agreement or the Contract Documents."

Paragraph 1.8 – Building Information Models Use and Reliance

DELETE beginning in the second line "and without having those protocols…….. Project Building Information Modeling Protocol Form,"

ARTICLE 2 - OWNER

Paragraph 2.1 - General

Subparagraph 2.1.1

CHANGE the first part of the first sentence to identify Owner as follows:

The City of Staunton, Virginia
116 W Beverley St
Staunton, VA 24401

Paragraph 2.2 – Evidence of the Owner's Financial Arrangements

DELETE Paragraph 2.2, including all subparagraphs, in its entirety.

Paragraph 2.3 Information and Services Required of the Owner

Subparagraph 2.3.3

CHANGE "shall employ" to "may employ" in the first line.

DELETE "as to whom Contractor has no reasonable objection" from the second line.

Subparagraph 2.3.4

DELETE the last sentence in its entirety, and in lieu thereof, SUBSTITUTE the following new sentence:

[*Substitute*] "Contractor shall be responsible to verify the accuracy of the site's physical characteristics, legal limitations and utility locations and bring to the attention of Owner and Architect any discrepancies suspected or discovered that may affect the Work."

Subparagraph 2.3.5

INSERT at the beginning of the first sentence: "Upon written request from Contractor,"

Paragraph 2.4 - Owner's Right to Stop the Work

DELETE the word "repeatedly" from the first sentence.

ADD the following to the end of the Subparagraph:

[*Add:*] "This right shall be in addition to and not in restriction of or derogation of Owner's rights under Article 14 hereof. Owner's right to stop the Work shall not relieve Contractor of its

responsibilities and obligations under or pursuant to the Contract Documents. In the event an order by Owner to stop the Work is determined to be inappropriate, it shall not constitute a breach of Contract by Owner, but rather shall be a suspension of Work for the convenience of Owner.

Paragraph 2.5 - Owner's Right to Carry Out the Work

INSERT in the first line ", or fails under any circumstances" after "defaults or neglects" in the same such sentence.

REVISE the second line of the first sentence from "a ten-day period" to a "a seven-day period" and INSERT "or failure" after the repeated phrases "default or neglect."

DELETE the second sentence in its entirety and, in lieu thereof, SUBSTITUTE the following new sentence:

In such case, Owner shall have the right to deduct from payments then or thereafter due Contractor, the cost to Owner of correcting such default or neglect or failure, including Owner's expenses and any fees or costs charged by contractors, consultants, experts, attorneys, Architect or Owner's Representative in connection with such corrective action.

ADD the following to the end of the Subparagraph:

[*Add:*] "Nothing contained herein shall obligate Owner to carry out work for the benefit of Contractor."

[*Add:*] "This right shall be in addition to and not in restriction of or derogation of Owner's rights under Article 14 hereof. Owners right to stop the Work shall not relieve Contractor of its responsibilities and obligations under or pursuant to the Contract Documents. *[Add:]* "Owner shall not be required to comply with the seven-day notice provision stated above, and shall have the right to immediately take any corrective action subject to the remaining provisions of this Paragraph 2.5, where providing such notice would impose risk of substantial disruption to the Project schedule or to the safety of any person or property, as determined in the sole discretion of Owner."

ADD new Paragraph 2.6 as follows:

Paragraph 2.6 – Owners Representative
Subparagraph 2.6.1

2.6.1 Owner's Representative during construction is Owner's designated and authorized representative to stop work for, including, but not limited to, unsatisfactory field test results, deficient materials, equipment or systems, deficient work or unsatisfactory installations. The following is a description of the services being provided by Owner's Representative to Owner and how Owner's Representative is to interact with Architect and Contractor. Owner's Representative shall assist Owner in observing performance of the work of Contractor. Owner's Representative shall endeavor to provide further protection for Owner against defects and deficiencies in the work of Contractor; but, furnishing of such services or taking any action will not make it responsible for or give them control over construction means, methods, techniques, sequences or procedures

or for safety precautions or programs, or responsibility for Contractor's failure to perform the Work in accordance strictly with the Contract Documents and in particular the specific limitations set forth in this Agreement as applicable. The duties and responsibilities of Owner's Representative are limited and described further as follows:

2.6.1.1 Owner's Representative is Owner's agent at the site and will act as directed by and under the supervision of Owner and will confer with Architect, Owner and Contractor, keeping Owner advised as necessary. Owner's Representative's dealings with subcontractors shall only be through or with the full knowledge and approval of Contractor.

2.6.1.2 Schedules: Review the progress schedule, schedule of shop drawing submittals and schedules of value prepared by Contractor and consult with Architect and Owner concerning acceptability and monitor Contractor's prepared Project Schedule and Contractor's progress and conformance with project completion dates, pursuant to the schedule criteria.

2.6.1.3 Conferences and Meetings: Attend meetings with Architect and Contractors, such as Pre-Construction Conferences, Progress Meetings, Job Conferences, and other project-related meetings.

2.6.1.4 Liaison: Service as Owner's liaison with Contractor, and assist in understanding the intent of the Contract Documents; assist Architect and Owner in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-site operations.

2.6.1.5 Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

2.6.2 Shop Drawings and Samples:

2.6.2.1 Advise Architect, Owner and Contractor of the commencement of any Work requiring a shop drawing or sample or if the submittal has not been approved by Architect and Owner.

2.6.3 Review of Work, Rejection of Defective Work, Inspections and Tests:

2.6.3.1 Conduct on-site observation of Work in progress to assist Architect and Owner in determining if the Work is, in general, proceeding in accordance with the Contract Documents.

2.6.3.2 Report to Architect and Owner whenever any Work is believed to be unsatisfactory, faulty, or defective or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Architect and Owner of Work that is believed should be corrected or rejected or should be uncovered for observation or requires special testing, inspection or approval. Owner's Representative shall be officially designated to act on Owner's behalf as its authorized representative to exercise Owner's right to stop and/or suspend work or reject materials, equipment and systems or other non-conforming, deficient, incomplete and unacceptable work in complete accordance with AIA General Conditions, Article 2.3, provided in the Contract Documents by Architect.

2.6.3.3 Verify that all tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that Contractor

maintains adequate records thereof; and observe, record, and report to Architect and Owner.

2.6.4 Interpretation of the Contract Documents: Report to Architect and Owner when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor any clarifications and interpretations as issued by Architect and Owner.

2.6.5 Modifications: Consider and evaluate Contractor's suggestions for modifications on Drawings or Specifications and report any recommendations to Architect and Owner. Transmit to Contractor decisions issued by Architect and Owner.

2.6.6 Records:

2.6.6.1 Maintain at the job site orderly files for correspondence, reports of Job Conferences, Shop Drawings and Samples, reproductions of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional drawings issued subsequent to the execution of the Contract, Architect and Owner clarifications and interpretations of the Contract Documents, progress reports, and other Project related documents.

2.6.6.2 Keep a diary or log book, recording Contractor hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures and send copies to Architect and Owner.

2.6.7 Reports:

2.6.7.1 Furnish Architect and Owner periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of shop drawing and sample submittals.

2.6.7.2 Consult with Architect and Owner in advance of scheduled major tests, inspections or start of important phases of the Work.

2.6.7.3 Report immediately to Architect and Owner upon the occurrence of any accident.

2.6.8 Payment Requests: Review Applications for Payment with Contractor for compliance with the established procedures for their submission and forward with recommendations to Architect and Owner, noting particularly the relationship of the payments requested to the Schedule of Values, Work completed and materials and equipment delivered at the site but not incorporated into the Work.

2.6.9 Completion:

2.6.9.1 Before Architect and Owner issue a Certificate of Substantial Completion, submit to Contractor a list of observed items requiring completion or correction.

2.6.9.2 Conduct a final inspection in the company of Architect, Owner, and Contractor and prepare a final list of items to be completed or corrected.

2.6.9.3 Observe that all items on the final list have been completed or corrected and make recommendations to Architect and Owner concerning acceptance.

2.6.10 Owner's Representative - Limitations of Authority:

2.6.10.1 Shall not authorize any deviation from the Contract Documents or substitution of materials or equipment, unless authorized by Architect and Owner.

2.6.10.2 Shall not exceed limitations of Architect and Owner's authority as set forth in the Agreement or the Contract Documents.

2.6.10.3 Shall not undertake or limit any of the responsibilities of Contractor, Subcontractors or Contractor's superintendent.

2.6.10.4 Shall not advise on, issue directions relative to or assume control over any aspect of the means, methods, techniques, sequences, or procedures of construction or safety unless such advice or directions are specifically required by the Contract Documents.

2.6.10.5 Shall not advise on, issue directions regarding or assume control over safety precautions and programs in connection with the Work.

2.6.10.6 Shall not authorize Owner to occupy the Project in whole or in part.

2.6.10.7 Shall not participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by Architect and Owner.

ARTICLE 3 - CONTRACTOR

Paragraph 3.1 - General

Subparagraph 3.1.1

ADD the following new sentence to the end of the Subparagraph:

[*Add:*] "It shall be understood that the term "Contractor", as used throughout the General Conditions, applies to each Contractor entering into a Contract with Owner except where specifically noted otherwise."

Paragraph 3.2 - Review of Contract Documents and Field Conditions by Contractor

Subparagraph 3.2.2

DELETE the second sentence in its entirety and, in lieu thereof, SUBSTITUTE the following new sentences:

[*Substitute:*] "Contractor shall not be liable to Owner or Architect for any costs, fees or damage resulting from errors, inconsistencies or omissions in the Contract Documents unless Contractor should have reasonably recognized or suspected such error, inconsistency or omission and failed to report it immediately to Architect. Contractor warrants that Contractor has carefully studied and reviewed the Contract Documents and that Contractor has reported any errors, inconsistencies or omissions to Architect. Contractor hereby acknowledges and declares that the Contract Documents are full and complete, are sufficient to have enabled Contractor to determine the cost of the Work and to fulfill all of Contractor's obligations under the Contract Documents. If Contractor encounters or suspects an error, inconsistency or omission, Contractor shall immediately submit it to Architect for resolution. If Contractor performs any construction activity knowing or having reason to know or suspect that it involves an error, inconsistency or omission, Contractor shall be responsible for such performance and shall bear the costs for correction. Contractor shall be liable to Owner for all costs and fees by consultants, experts, attorneys or Owner's Representative, and fees and costs for Additional Services of Architect (as defined in the Prime Agreement between Owner and Architect) to the extent that such fees and costs are caused by or arise from any deficient Work or the negligent acts or omissions or failure of Contractor. The Owner is not required to ascertain that the Contract Documents are in accordance with

applicable laws, statutes, ordinances, building codes, and rule and regulations, but any nonconformity discovered or suspected by or made known to the Contractor shall be reported promptly to the Architect. The Contractor stipulates and agrees that the Owner has no duty to discover any design errors or omissions in the Drawings, Plans, Specifications and other Construction Documents and has no duty to notify Contractor of same. By entering into the Contract Documents or any agreement with any Architect, Owner does not warrant the adequacy and accuracy of any Drawings, Plans, Specifications or other Construction Documents.

Subparagraph 3.2.4

DELETE Subparagraph 3.2.4 in its entirety.

Paragraph 3.3 - Supervision and Construction Procedures
Subparagraph 3.3.2

ADD the following to the end of the last Subparagraph:

[*Add:*] "…or claiming by, through or under Contractor and for any damages, losses, costs and expenses resulting from such acts or omissions. If any failure by Contractor to comply with the Contract Documents or to maintain an approved project schedule causes any damage or costs to Owner, then Contractor shall indemnify and hold harmless Owner for any such damage or costs. Such damage or cost to Owner shall include any payment by Owner to others or liability of Owner to others resulting from such failure by Contractor, including but not limited to (1) any payment for liability arising from change orders, claims, or (2) any payment or liability for fees or costs to Owner's Representative, Architect, consultants, experts and attorneys.

Subparagraph 3.3.3

ADD the following new sentences to the end of the Subparagraph:

[*Add:*] "In the event Contractor discovers or suspects that portions of the Work related to another Prime Contractor's work are not in proper condition to receive subsequent work, Contractor shall notify Architect immediately of such. In the event Contractor fails to so notify Architect immediately of such or otherwise fails to inspect previous Work in accordance herewith, and proceeds, Contractor shall be responsible for any such costs associated therewith.

ADD the following new Subparagraphs:

3.3.4 The General Contractor is designated as the Lead Contractor for this Project. Each Sub-Contractor shall coordinate its work with the work of the Lead and other Sub-Contractors. The Lead Contractor is responsible for making all coordination decisions not mutually agreed to by the affected Sub-Contractors. Disputes between the Lead Contractor and one or more Sub-Contractors and disputes between two or more Sub-Contractors pertaining to the creation, application, and modification of the Project Schedule, the furnishing of additional resources to meet the project schedule, job coordination, and all aspects of the coordination, means and methods of construction shall be submitted promptly to the Lead Contractor for a final construction decision. The final construction decision of the Lead Contractor must, at all times, be consistent with the content and intent of the Contract Documents. The final construction decision of the Lead Contractor

shall be observed, accepted and fully followed by the Lead Contractor and all Sub-Contractors and their Subcontractors and Sub-subcontractors on the Project, subject only to the commencement of a proceeding pursuant to provisions of Article 15 at the request of the Lead Contractor or other Sub-Contractor. The progress of the Work in accordance with the final construction decision of the Lead Contractor shall not be delayed pending any proceeding pursuant to Article 15. The damage remedy in any Article 15 proceeding or dispute resolution proceeding in favor of the Lead Contractor or other Sub-Contractor shall be the exclusive remedy for disputes between or among Contractors. Contractors, including the Lead Contractor, shall have no right of action against Owner in connection with such disputes.

3.3.5 In the event any of the Work is required to be inspected or approved by any governmental authority having jurisdiction, Contractor shall cause such inspection or approval to be scheduled and performed. No inspection performed or failed to be performed shall release Contractor from its obligations to have such work inspected nor shall it be construed as an approval or acceptance of the Work or any part thereof.

3.3.6 Refer to Division 1, Section "Project Coordination" for detailed requirements regarding coordination of multiple prime contracts.

Paragraph 3.4 - Labor and Materials
Subparagraph 3.4.1

ADD the following new Sub-subparagraph to Subparagraph 3.4.1:

3.4.1.1 Refer to Division 1, Section "Temporary Facilities and Controls ", for detailed requirements regarding temporary utilities, services, and facilities.

Subparagraph 3.4.3

ADD the following new sentence to the end of the Subparagraph:

[*Add:*] "Owner encourages but does not require that laborers and mechanics employed on the Project be residents of the City in which the work is being performed. Contractor shall be licensed in accordance with all applicable requirements of the Commonwealth of Virginia and the City of Staunton. Upon request of Owner, Contractor shall remove from the project any worker who is believed to be incompetent, careless or unsafe or is believed or suspected to put at risk the safety or welfare of any person or of the security of any property. The Contractor acknowledges that there may or will be employees of the Owner on or about the location where the Work is being performed and shall take affirmative precautions and institute specific safeguards to protect such persons at all times, including but not limited to conducting any update to background checks, and the use and display of photographic and name identification badges."

ADD the following new subparagraph:

3.4.5. The Contractor shall disclose in writing the existence and extent of any financial interests, whether direct or indirect, he has in subcontractors and material suppliers which he may propose for the Project.

Paragraph 3.5 – Warranty

Subparagraph 3.5.1

DELETE “inherent in the quality of the work the Contract Documents require or permit” from the second sentence.

DELETE the word “may” from the third sentence and replace it with “will”.

ADD to the following to the end of the third sentence.

[*Add*] “unless Owner accepts in writing such nonconforming Work.”

ADD the following new sentence to the end of the Subparagraph:

[*Add:*] “Contractor will fully secure and protect both new work and existing conditions during the period of construction which may be susceptible to damage or abuse or risk of loss in any regard.

ADD the following new Subparagraphs:

3.5.3 Contractor’s warranty period shall be 1 year from the date of Substantial Completion of the Work and/or phase of the Work, except for specific items of work or equipment for which the warranty period is specified as a longer period elsewhere in the Contract Documents. Equipment and facilities which have seasonal limitations on their operation (e.g. heating or air conditioning units) shall be guaranteed for one (1) full year from the date of seasonally appropriate tests and acceptance, in writing, by the Owner. During the warranty period, Contractor shall promptly correct all defects which are due to defective materials or workmanship at no cost to Owner. Such correction shall extend to any other Work damaged or compromised by such correction.

3.5.4 At the end of the 11-month period from Substantial Completion from the commencement of the warranty period, Contractor shall schedule a walk-through inspection with Owner and Architect to identify any warranty items to be corrected under such warranty period.

3.5.5 Contractor shall be responsible for timely initiating and scheduling the eleven (11) month walk-through inspection contemplated in this warranty Section.

Paragraph 3.7 - Permits, Fees, Notices and Compliance with Laws
Subparagraph 3.7.1

DELETE Subparagraph 3.7.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

3.7.1 Contractor for General Construction shall secure the general building permit for the Project. Fees for this permit shall be paid directly by Owner.

Owner, through Architect, will submit drawings and specifications to the appropriate public authorities having jurisdiction, for approval. Owner will pay all fees for plan checking.

Subparagraph 3.7.3

INSERT “or suspecting” after “knowing” in the first line.

ADD the following new sentence to the end of Subparagraph 3.7.3:

[*Add:*] “Owner shall not be responsible for any inspection fees due to re-inspection of rejected work due to faulty or defective workmanship of Contractor, or scheduling error by Contractor.

Paragraph 3.7.4 – Concealed or Unknown Conditions

In the first sentence, strike “14” and substitute “3” before “days.”

Paragraph 3.8 - Allowances

DELETE Paragraph 3.8 in its entirety. No cash allowances are permitted.

Paragraph 3.9 – Superintendent

DELETE the final sentence of Subparagraph 3.9.3 and SUBSTITUTE the following:

[*Substitute:*] “The Contractor shall notify the Architect and Owner in writing of any proposed replacement of an incumbent Superintendent. The Contractor shall not voluntarily replace a Superintendent without prior written and discretionary approval from the Owner. The requirements contained in this Article shall apply to any proposed replacement Superintendent, regardless if the proposed tenure is to be temporary or permanent.”

Paragraph 3.10 - Contractor’s Construction and Submittal Schedules

ADD new Sub-subparagraph 3.10.1.1 as follows:

3.10.1.1 Refer to Division 1, Section “Construction Progress Documentation”, for further requirements regarding construction schedules.

Paragraph 3.11 - Documents and Samples at the Site

DELETE the last sentence of Paragraph 3.11 and, in lieu thereof, SUBSTITUTE the following new sentence:

[*Substitute:*] “These shall be in electronic form or paper copy, available to Architect and Owner, and shall be delivered to Owner, in good condition, upon completion of the Work, and before final payment is made.”

Paragraph 3.12 - Shop Drawings, Product Data and Samples
Subparagraph 3.12.4

ADD the following new Sub-sub paragraphs:

3.12.4.1 Issuance of the Design Professional’s Instruments of Service via electronic media in either .dwf or .dwg file format, hereinafter referred to as “Media” will be provided at the request of Contractor. This Media is provided without detail and dimensions and

is for illustrative purposes only and does not amend, supplement or replace any drawing, Contract Document, Specification and/or in any way, the Contract requirements of such. The purpose of this Media is solely for coordination by Contractor and shall not be relied upon for any other purpose. Contractor fully releases the Design Professional, its agents, officers, and employees, and consultants, from any and all liability, including without limitation, damages, consequential damages, costs and attorney's fees that Contractor may incur as a result of its reliance on the information contained in the Media.

3.12.4.2 In accepting and utilizing Media provided by the Design Professional, Contractor covenants and agrees that all such Media are instruments of service between the Design Professional and the client of the Design Professional, who shall be deemed the author of the Media, and the Design Professional shall retain all common law, statutory law and other rights, including copyrights, whether or not such copyright is registered. Contractor acknowledges that the information and designs contained on the Media are provided to Contractor as a convenience and at the request of Contractor. Contractor also acknowledges that there may be undiscovered errors or inconsistencies in the Media that may result from any number of issues, including migrating the data from printed material to the Media or from others adding information to, or changing information in, the Media once transmitted to Contractor. Contractor agrees not to hold the Design Professional responsible for any defects Contractor may discover with the Media or information contained in the Media.

3.12.4.3 Contractor agrees not to use the Media, in whole or in part, for any purpose or project other than the Project of this Contract. Contractor agrees to waive all claims against the Design Professional resulting in any way from use of the Media.

3.12.4.4 Contractor agrees, to the fullest extent permitted by law, to defend, release, indemnify and hold the Design Professional harmless from and against any and all claims, damage, loss, liability or cost, including reasonable attorney's fees and costs of defense, arising out of or resulting from any changes made by anyone other than the Design Professional, or from any reuse of the Media, and data contained on the Media without the prior written consent of the Design Professional.

3.12.4.5 Contractor recognizes that information contained on the Media may not be 100% compatible with Contractor's computer system; therefore, Contractor agrees that the Design Professional shall not be liable for the completeness or accuracy of any materials provided on the Media arising out of, due to, or resulting from the difference in computer and software systems, or translations or mistranslation of electronic data, the incompatibility of viewing or operating programs, or the corruption of documents or data as a result of compatibility issues.

3.12.4.6 Contractor recognizes that information stored on electronic media including, but not limited to, computer disks may be subject to undetectable alteration and/or uncontrollable deterioration, due to, among other causes, errors in transmission, conversion, media degradation, software error or human error or alteration. Accordingly, the Media is provided for informational purposes only and is not intended as an end-product. Contractor therefore agrees that the Design Professional shall not be liable for the completeness or accuracy of any materials provided on the Media for this or any other reason whatsoever.

3.12.4.7 Under no circumstances shall the transfer of instruments of service in electronic media, for use by Contractor, be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either expressed or implied, of merchantability and fitness for any particular purpose of the electronic media, or the

information stored or contained thereon. Contractor acknowledges that the Media is provided as a convenience by the Design Professional at Contractor's request, and Contractor assumes all risk in the use of the Media, and the data contained therein for any purpose. Contractor further acknowledges that the Design Professional was not engaged to provide usable electronic data, or a usable system, compilation, Model or program to Contractor or any other party. Contractor agrees that the Design Professional shall not be liable in any manner whatsoever for any subsequent usage of the data provided on electronic media.

3.12.4.8 Contractor agrees that in the event of a conflict between non-electronic data and data provided on the Media, including but not limited to the Model, the data contained on non-electronic documents presides over data on the Media. While the Design Professional has made a reasonable effort in accordance with the generally accepted standards of professional skill and care so that the data contained on the Media is accurate, the Design Professional makes no representation or warranty concerning the accuracy of the data contained on the Media, or any viruses contained in the materials as delivered or any other defect or error or alleged defect or error in the materials as delivered.

3.12.4.9 Contractor, by submitting a Bid and requesting electronic media from the Design Professional, accepts all terms of use of the Media as stated herein. Media will be provided to Contractor, upon Contractor's request, and upon remittance of payment to the following schedule:

- 1 to 10 Sheets as they appear in the Contract Documents - $100
- 11 to 20 Sheets as they appear in the Contract Documents - $200
- 21 to 30 Sheets as they appear in the Contract Documents - $300
- 31 to 40 Sheets as they appear in the Contract Documents - $400

The above costs apply to Architectural sheets only. The cost for electronic files for the engineering disciplines may vary. The Engineer of Record, as the author of the engineering drawings, shall be contacted directly for cost information, and the procedures for requesting their electronic media.

Subparagraph 3.12.10

ADD ", but if the Contractor becomes aware of any inadequacy or inaccuracy in such Contract Documents, he shall bring such inadequacy or inaccuracy to the attention of the Architect." after "The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents".

ADD new Subparagraph 3.12.12 as follows:

3.12.12 Refer to Division 1, Section "Submittals", for further requirements regarding shop drawings, product data and samples.

Paragraph 3.13 Use of Site
Subparagraph 3.13.1

ADD new Subparagraph 3.13.1 as follows:

3.13.1 Control or Reference Points: Immediately upon occupancy of the project site for the purpose of commencement of the Work, Contractor shall locate, including but not limited to, all general control or reference points, benchmarks, etc., and take such action as may be necessary to prevent damage or destruction of such points. In the event Contractor fails to do so, Contractor shall be liable for all such costs, including but not limited to professional fees and costs, necessary to re-establish such control or reference points.

Paragraph 3.14 - Cutting and Patching

DELETE Paragraph 3.14, including all subparagraphs, in its entirety, and in lieu thereof, SUBSTITUTE it with the following new Paragraph:

3.14 Refer to Division 1, Section "Cutting and Patching", for requirements regarding cutting and patching.

Paragraph 3.15 Cleaning Up
Subparagraph 3.15.1

ADD new Subparagraph 3.15.3 as follows:

3.15.3 Refer to Division 1, Section "Contract Closeout", for further requirements regarding cleaning up.

Paragraph 3.18 Indemnification
Subparagraph 3.18.1

ADD ", defend, " after the word "indemnify" and "of any kind" after the word "expenses" in the first sentence.

ADD "Contractor's breach of any obligation or warranty under this Agreement, or from " after the word "from" on line 3.

DELETE "negligent" before the phrase "acts or omissions" in the first sentence.

DELETE "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)" from the first sentence.

ADD the following to the end of the subparagraph:

[*Add:*] Contractor's indemnification obligation shall not apply when the claim, damage, loss, or expense is caused by the sole negligence of the Owner or its employees. This indemnity agreement shall impose liability on the Contactor to the fullest extent permitted by the laws of Virginia, and any provision hereof not permitted by such laws is expressly deleted from said agreement. For the avoidance of doubt, the acts or omissions described in (b) above shall include, without limitation, (i) any act or omission of a person described in providing supervisory, inspection or engineering services, (ii) any act or omission of a Performing Party in connection with any design, application, professional advice or opinion rendered to the Owner or on the Owner's behalf, and (iii) any act or omission of a Performing Party in connection with the use or

misuse of any substance, material, machinery, hoist, rigging, block, scaffolding, or any and all kinds of equipment whether or not owned, furnished or lent by the Owner."

ADD the following new subparagraphs as follows:

3.18.3 In the event of accidents involving personal injury or property damage, the Contractor shall immediately notify the Owner, furnishing as much data as is available. As soon as practicable, Contractor shall furnish to the Owner a written report indicating the extent of the damage, the persons involved, the employer of the persons involved and the number of days each person is hospitalized. Notification of any accident shall not relieve the Contractor of its obligations regarding safety for the Project.

3.18.4 The purchase of insurance by the Contractor shall in no event be construed as a fulfillment or discharge of the obligations set forth in this section.

3.18.5 Where the facts or the law relating to any threatened or actual claim would preclude the Indemnified Party from being completely indemnified, the indemnified party will be partially indemnified by the indemnifying party to the fullest extent permitted by the law.

ADD the following new Paragraphs as follows:

3.19 Contractor shall indemnify and hold harmless Owner for any additional fee, cost or expense (beyond a base fee) charged to Owner by Architect or other project consultant pursuant to its own agreement with Owner to the extent such additional fee, cost or expense is caused by Contractor's acts or omissions.

3.20 Owner may deduct amounts owed by Contractor pursuant to Paragraph 3.18 or 3.19 from payments otherwise due to Contractor, and upon request of Owner shall provide Contractor a copy of the written agreement regarding such additional fee, cost or expense payment.

ARTICLE 4 - ARCHITECT

Paragraph 4.1 - General

Subparagraph 4.1.2

DELETE the word "Contractor" from the second line.

Paragraph 4.2 – Administration of the Contract

Subparagraph 4.2.3

INSERT "or suspected" before "deviations" and INSERT "or suspected" after "observed" each time such words occur in the first sentence.

Subparagraph 4.2.4

DELETE the first and second sentences in their entirety and, in lieu thereof, SUBSTITUTE the following:

[*Substitute:*] "Owner and Contractor shall endeavor to communicate with each other through Architect about matters arising out of or relating to the Contract."

Subparagraph 4.2.5

ADD to the end of the subparagraph, the following:

[*Add:*] ", with Certificates for Payment being subject to Owner approval."

Subparagraph 4.2.6

ADD the following to the end of the first sentence.

[Add:] "and shall do so unless Owner accepts, in writing, such nonconforming work"

Subparagraph 4.2.8

Add new Sub-subparagraph as follows:

4.2.8.1 No change in the Work will give rise to an increase in the Contract Sum without a Change Order expressly providing for such increase, and that the Contractor waives any claim for such an increase based upon unjust enrichment, course of dealings or implied or express acceptance.

Subparagraph 4.2.9

ADD after "Certificates of Substantial Completion" AND after "a final Certificate for Payment", both in the first sentence, the following:

[*Add:*] "subject to Owner approval,"

ARTICLE 5 – SUBCONTRACTORS

Paragraph 5.2 - Award of Subcontracts and Other Contracts for Portions of the Work

Subparagraph 5.2.3

DELETE the second and third sentences in their entirety and, in lieu thereof, SUBSTITUTE the following:

[Substitute:] "In the event of any such objection, Contractor shall not contract with the proposed person or entity, and there shall be no increase in the Contract Sum or Contract Time."

ADD new Paragraph 5.5 as follows:

Paragraph 5.5 - Payment to Subcontractors

5.5.1 Contractor shall pay each subcontractor, upon receipt of payment from Owner, an amount equal to the percentage of completion allowed to Contractor on account of such subcontractor's Work, less the percentage retained from payments to Contractor; PROVIDED, however, that Contractor shall make no payment to any subcontractor unless the subcontractor shall execute a waiver of liens in favor of Owner and Contractor

reflecting the amount of each such payment. Contractor shall also require each subcontractor to make similar payments to sub-subcontractors. All such payments shall be paid within the time limits required by the Commonwealth of Virginia – VPPA, and shall be subject to the provisions contained in Section 000515.

5.5.2 If Owner fails to approve an Application for Payment for a cause which Owner and Architect determine is the fault of Contractor and not the fault of a particular subcontractor, or if Contractor fails to make payment which is properly due to a particular subcontractor, Owner may pay such subcontractor directly, less the amount to be retained under its Subcontract. Any amount so paid by Owner shall be repaid to Owner by Contractor. Owner shall have no obligation to pay or to see to the payment of any monies to any subcontractor. Nothing contained in Paragraph 5.5 shall be deemed to create any contractual relationship between Owner and any subcontractor or to create any rights in any subcontractor against Owner. Contractor shall promptly advise Owner of any claim or demand by a subcontractor claiming that any amount is due to such subcontractor or claiming any default by Contractor in any of its obligations to such subcontractor.

ARTICLE 6 – CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

Paragraph 6.1 – Owners Right to Perform Construction and to Award Separate Contracts

DELETE "and waiver of subrogation" in Subparagaph 6.1.1.

DELETE Subparagraph 6.1.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

6.1.3 It is the sole duty and responsibility of the Contractor to plan, direct, perform and coordinate its Work as to cause no delay, hindrance, loss, injury, or similar damage to subcontractors or material suppliers. In the event the Contractor causes any delay, hindrance, loss, injury, or similar damage to subcontractors or material suppliers, the aggrieved subcontractors or material suppliers may pursue recovery of money damages against the Contractor pursuant to Article 15. There shall be no claim asserted against the Owner or the Architect, or their respective directors, employees or agents for money damages based on the alleged acts or omissions with respect to coordinating, expediting or directing the Work. If the Contractor prosecutes a claim against the Owner or the Architect for money damages or for an alleged failure to coordinate, expedite or direct the Work, then the Contractor shall indemnify and hold harmless the Owner and the Architect against any and all costs, losses or expenses, including consulting, expert, counsel fees, that the Owner or the Architect incur in responding to any such claim plus 10% interest per annum on all such costs from the date of occurrence of such costs up to the date of payment.

Paragraph 6.2 – Mutual Responsibility

Subparagraph 6.2.2

INSERT "or suspected" before "apparent" in the first, second, and third sentences.

Subparagraph 6.2.3

DELETE the second sentence of Subparagraph 6.2.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new sentence:

[*Substitute:*] "Costs caused by delays, or by improperly timed activities or defective construction shall be borne by the responsible party therefore. Contractor shall indemnify Owner for any costs, damages or payments Owner incurs (including any payments to other contractors, Architect, legal counsel, agents or consultants) arising from or relating to Work by Contractor that is not in compliance with the Contract Documents. Owner may withhold payments otherwise due to Contractor in the event of such indemnification duty.

ADD the following new sentence to the end of Subparagraph 6.2.4:

[*Add:*] "Contractor agrees to indemnify and hold Owner and Architect harmless for any claims or damages brought by a separate contractor arising out of the actions or omissions of Contractor, its subcontractors or suppliers in performing their work under the Contract Documents.

ARTICLE 7 - CHANGES IN THE WORK

Paragraph 7.1 – General

Subparagraph 7.1.1

INSERT "and applicable law" after the word "Documents" at the end of the sentence.

Subparagraph 7.1.2

REVISE the first part of the first sentence of Subparagraph 7.1.2 to read as follows:

[*Revise:*] "A Change Order shall be based upon agreement between Owner and Contractor; a Construction Change Directive ……."

Subparagraph 7.1.3

DELETE Subparagraph 7.1.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.1.3 Before any Change Order is prepared, Contractor shall submit to Architect, in writing, an itemized breakdown of the cost of the proposed Change in the Work. The term "cost" shall be interpreted to mean and include the actual, verified incremental cost of the following:

1. Labor, including foremen.
2. Materials at cost plus applicable taxes entering permanently into the Work.
3. Rental cost of construction plant and equipment, whether rented from Contractor or others.
4. Power and consumable supplies for the operation of power equipment.
5. Liability insurance and bonds.
6. Social security, old age and unemployment contributions.

When determining the labor costs of Work by Change Order, Contractor shall use the actual wage paid to the personnel performing the Work, and if requested by Owner or Architect, at any time during or after the project, Contractor shall provide certified payroll records necessary to evidence those labor costs. Using the actual wage paid to the personnel performing the Work, Contractor shall be entitled to fifteen percent (15%) of the total cost of the above for overhead, profit, supervision and miscellaneous expenses if they perform the Work with their own forces, or to the Subcontractor who performs the Work. In the case where the Work is performed by a subcontractor, Contractor may add five percent (5%) to the Subcontractor's total amount as Contractor's commission. Where Change Orders include both increases and decreases in the Contract Amount, the above fifteen percent (15%) will be allowed on the net increase only.

Paragraph 7.2 - Change Orders
Subparagraph 7.2.1

DELETE Subparagraph 7.2.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.2.1 A Change Order is a written instrument prepared by Architect and signed by Owner, Contractor and Architect. A Change Order is the only method by which the Contract Sum and/or the Contract Time may be adjusted. A Change Order shall provide for the following: (1) a change in the Work, if any; (2) the amount of the adjustment in the Contract Sum, if any; and (3) the extent of the adjustment in the Contract Time, if any.

ADD the following new Subparagraphs:

7.2.2 Contractor is responsible for submitting verified accurate cost and pricing data to support its proposals for change orders and other Contract price adjustments under the Contract Documents. Contractor shall certify in writing that to the best of its knowledge and belief, the cost and pricing data submitted is accurate, complete, current and in accordance with the terms of the Contract Documents with respect to pricing of change orders. Contractor shall also certify in writing that he has made reasonable good faith inquiries to appropriate individuals within its organization to confirm that the data submitted is net of all discounts, rebates, savings, and other reductions and is accurate, complete and current. The above-described certification shall be required for all change order requests with a positive or negative value greater than $1,000.00. If it is later determined by audit or by other means that the cost and pricing data submitted is not net of all discounts, rebates, savings, and other reductions, inaccurate, incomplete, not current or not in compliance with the terms of the Contract Documents regarding the pricing of change orders, then an appropriate contract price reduction shall be made.

7.2.3 Contractor shall perform the work of Change Orders only with personnel appropriate for the tasks performed. Should Contractor use overqualified personnel, Contractor shall only be entitled to payment for the work at the wage rate of the appropriate personnel, plus the applicable multipliers noted in 7.1.3.

7.2.4 Any Contractor creating the need for Additional Services by Architect, with respect to a Change Order, shall pay all costs associated with such Additional Services, and Architect shall prepare and present to Owner for approval, a Change Order or Construction Change Directive regarding such costs.

Paragraph 7.3 – Construction Change Directives
Subparagraph 7.3.2

ADD new Sub-subparagraph 7.3.2.1 as follows:

7.3.2.1 Any Contractor creating the need for Additional Services by Architect, with respect to a Construction Change Directive, shall pay all costs associated with such Additional Services, and Architect shall prepare and present to Owner for approval, a Change Order or Construction Change Directive regarding such costs.

ARTICLE 8 - TIME
Paragraph 8.1 – Definitions
Subparagraph 8.1.3

INSERT after "Architect", the following:

[*Insert:*] "and approved by Owner"

Subparagraph 8.2.2

INSERT "and submission to the Owner of certificates" after "date" in the sentence.

Paragraph 8.3 – Delays and Extensions of Time
Subparagraph 8.3.1

DELETE (3) in its entirety and, in lieu thereof, SUBSTITUTE the following:

[*Substitute:*] "(3) by fire or adverse weather conditions documented in accordance with Section 15.1.6."

DELETE (4) in its entirety and, in lieu thereof, SUBSTITUTE the following:

[*Substitute:*] "(4) by delay authorized by Owner pending a proceeding pursuant to Article 15; or"

ADD the following new sentences to the end of Subparagraph 8.3.1:

[*Add:*] "All claims for extension of time shall be made, in writing, to Architect and Owner no more than seven (7) days after the occurrence of the event causing the delay. If an extension of the Contract Time for a contractor is granted due to neglect, misconduct or failure to comply with the Contract Documents by another contractor and such delay causes any contractor to miss a Milestone in the Project Schedule, then liquidated damages for delay pursuant to Paragraph 8.4, caused by the delay, shall be applied against Contractor responsible for having caused such extension of the Contract Time. A contractor causing Project delay shall be liable for and reimburse Owner for all costs, including any additional fees to Architect resulting from such delay.

Subparagraph 8.3.3

DELETE Subparagraph 8.3.3 in its entirety and, in lieu thereof, SUBSTITUTE the following:

8.3.3 Contractor recognizes that delays, acceleration or hindrances to the Work may occur. To the fullest extent permitted by law, no claim or litigation for increased costs, charges, expenses or damages of any kind shall be filed by Contractor against Owner, Architect or Owner's Representative (or against any of their respective employees or agents) for any delays, acceleration, hindrances, or sequencing of work due to any cause whatsoever, notwithstanding whether such delays are caused by factors within or outside Contractor's control. Contractor's sole remedy for delays, acceleration, hindrances or sequencing of work (except against a responsible contractor pursuant to subparagraphs 3.3.4 and 6.1.3) shall be an extension of the Contract Time pursuant to this Paragraph 8.3. No additional compensation will be allowed for time extensions (including time extensions based on weather). Should Contractor file any claim or litigation for money damages against Owner, Architect or Owner's Representative (including their employees or agents) contrary to this provision, such contractor shall pay all costs imposed or permitted by law to be recovered, including as allowed indemnification for any costs incurred as to such claim and all fees by consultants, experts, and attorneys, plus 10% interest per annum on all such costs from the date of occurrence of such costs up to the date of payment.

ADD new Paragraph 8.4 as follows:

Paragraph 8.4 – Liquidated Damages for Delays

8.4.1 Owner and Contractor stipulate that delay by the Contractor in completion would have significant adverse consequences for the Project; that, however, the actual damages to Owner from such delay are uncertain and would be impossible and not susceptible to reasonable determination; and that liquidated damages of such failure by Contractor to perform in a timely manner are a reasonable way and not a penalty to address such adverse consequences. Contractor also stipulates that it shall not challenge, either directly or indirectly, this liquidated damages provision. Owner, therefore, may require Contractor to pay liquidated damages of $1,500 per day for the Contractor's failure to perform timely in strict accordance with the Contract. **The amount of Liquidated Damages shall be $1,500 per day, per phase.**

8.4.2 If, during the course of Contractor's performance of the Work, Contractor shall fail to complete the Work, or portions thereof, in accordance with Specific Dates or the Contract Time, Owner may retain the amount of liquidated damages for which Contractor shall be liable to Owner under the Contract Documents, from amounts which become payable or are otherwise certified as payable to Contractor under the Contract Documents.

8.4.3 In the event that the Work must be conducted beyond the normal working hours specified or if the Project is not completed within the specified duration, Contractor shall indemnify Owner for any costs, damages or payments incurred by Owner, including payments to the Owner's Representative, Architect, consultants, experts, or legal counsel.

8.4.4 If Contractor files any claim or litigation challenging an assessment of liquidated damages, or the daily or total amount of liquidated damages assessed, and does not prevail completely in such challenge, Contractor shall be liable to Owner for all costs incurred by Owner in defending against the challenge, including all fees and costs of the attorneys, experts, architects, and other consultants, and all costs related to the time of the Owner's

Representative, Owner's staff and administrators based on the applicable compensation rates.

ARTICLE 9 - PAYMENTS AND COMPLETION

Paragraph 9.1 Contract Sum
Subparagraph 9.1.2

ADD the following new Sub-subparagraphs:

9.1.2.1 Owner reserves the right to accept or reject any and all Unit Prices stipulated on the Bid Form.

9.1.2.2 If quantities originally contemplated are materially changed so that application of a unit price will cause a substantial inequity to Owner the Owner reserves the right to equitably adjust the Unit Price or to require that the work be performed on a time and material basis.

Paragraph 9.2 – Schedule of Values

ADD new Subparagraph 9.2.1 as follows:

9.2.1 Refer to Division 1 Section, "Applications for Payment" for requirements regarding the schedule of values.

ADD new Subparagraph 9.2.2 as follows:

9.2.2 The Schedule of Values shall be prepared in such a manner that each major item of Work and each subcontracted item of Work is shown as a line item on AIA Document G703, Application and Certificate for Payment Continuation Sheet. Each major item of Work shall be further broken down into separate line items for work done in each area of the building, site and each phase of construction. Each work item shall be broken down into separate line items for material and labor. Each line item shall include quantities and unit prices in such detail as required by Architect.

Paragraph 9.3 - Applications for Payment
Subparagraph 9.3.1

DELETE Subparagraph 9.3.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

9.3.1 At least fifteen (15) days before the date established for each progress payment, Contractor shall submit to Architect an itemized Application for Payment for Work completed in accordance with the Contract Documents. Such application shall be notarized and supported by such data substantiating Contractor's right to payment as Owner or Architect may require, such as copies of requisitions, and releases and waivers of liens from subcontractors and suppliers and reflecting retainage.

Notwithstanding the language in §9.10.5 or any other section hereof, before Owner shall have any obligation to release any payments for Work completed to Contractor,

Contractor shall deliver an executed and notarized "Partial Waiver and Release of Mechanics Lien Claims" in the form provided. The partial waiver of liens shall waive Contractor's right to file a lien against the Property or Owner for an amount equal to the payment received by Contractor at that time.

Contractor shall obtain and post a bond guaranteeing payment for labor and materials provided by subcontractors in an amount, form and a surety acceptable to Owner and in compliance with applicable law.

Contractor hereby agrees that it will defend, indemnify and hold harmless Owner from and against any subcontractor's labor or materials claims, mechanics' lien or any other claim or proceeding filed by any subcontractor by reason of Contractor's failure to pay the Subcontractor any amount owed to such Subcontractor. Although this Project is a public entity project and not subject to the assertion of liens under applicable law, Contractor shall prevent the filing of any mechanics' lien, or should a lien be filed, Contractor shall undertake any and all action necessary to remove said lien or cloud on title. Any failure of Contractor in any of its obligations in this § 9.3.1 shall constitute a material breach of this Contract. Furthermore, Contractor shall be obligated to pay Owner all of Owner's costs incurred in defending or removing any such mechanics' lien whether filed by Contractor or any subcontractor. This shall include payment of all of Owner's attorney's fees, whether incurred in removing any cloud or challenging any mechanics' lien claim filed by Contractor or any subcontractor, or in enforcing Contractor's obligations hereunder.

Owner shall retain five percent (5%) of all amounts due Contractor until the Work is substantially complete and the punch list is complete and deemed satisfactory by the Architect and Owner's Representative. The retained percentage will be paid with the final Payment or as otherwise provided hereafter. In the event a dispute arises between Owner and Contractor, which dispute is based upon increased costs claimed by Contractor occasioned by damages or other actions of another contractor, additional retainage, in the sum of one and one half times the amount of any possible liability, may be withheld until such time as a final resolution is agreed to by all parties directly or indirectly involved, unless Contractor causing the additional claim furnishes an additional bond satisfactory to Owner to indemnify Owner against the claim.

The full Contract retainage may be reinstated at any time if the manner of completion of the Work and its progress do not remain satisfactory to Owner or Architect or if Surety withholds its consent or for other good and sufficient reasons.

ADD new Sub-subparagraph 9.3.1.4 as follows:

9.3.1.4 Refer to Division 1 Section "Applications for Payment" for additional requirements regarding applications for payment.

DELETE the second sentence and the word "Payment" from the beginning of the third sentence in Subparagraph 9.3.2, and SUBSTITUTE in its place the following:

[*Substitute:*] "When an application for payment includes products stored off the project site or stored on the project site but not incorporated in the Project, for which no previous payment has been requested, a complete description of such product shall be attached to the application.

Suitable storage which is off the project site shall be a bonded warehouse with the stored products properly tagged and identifiable for the Project. The Owner's written approval shall be obtained before the use of an off-site storage is made. If the size, quantity, and/or type of material or product is such that a bonded warehouse is deemed unsuitable, then, with the Owner's approval, the Contractor may elect to store certain products on his premises, or to repay a subcontractor or supplier for certain material and products which are to remain on and be stored on the subcontractor's or supplier's premises until needed by the project. In such event, the Contractor shall enter into a security agreement with the subcontractor or supplier under which the Contractor shall be granted a security interest in and to all such material and products fabricated and/or to be supplied by the subcontractor or supplier for this Project and stored on the subcontractor's or supplier's premises. All expenses incurred in this agreement be the responsibility of the Contractor. A copy of each and every agreement shall be filed with the Architect with the first application for payment which requests payment for such material or products. In any event, payment…"

Paragraph 9.5 - Decisions to Withhold Certification
Subparagraph 9.5.1

DELETE the first sentence of Subparagraph 9.5.1 and, in lieu thereof, SUBSTITUTE it with the following:

[*Substitute:*] "Architect shall not certify payment and shall withhold a Certificate for Payment in whole or in part to the extent necessary to protect Owner."

REVISE the following Sub-subparagraphs as follows:

9.5.1.7 DELETE the word "repeated".

ADD the following new Sub-subparagraphs:

9.5.1.8 Unsatisfactory prosecution of the Work in strict accordance with the Contract Documents.
9.5.1.9 Failure to comply with any statute, ordinance regulation or other legal requirement.
9.5.1.10 Failure to submit progress schedule updates as required by the Contract Documents.
9.5.1.11 Failure to submit wage certification as required by the Contract Documents.
9.5.1.12 Failure to submit a Schedule of Values that is acceptable to Architect.

Add a new Sub-subparagraph 9.5.2.1 as follows:

9.5.2.1 The Owner shall not be in breach for withholding payment so long as it does so in good faith based upon a bona fide dispute. The Contractor may not stop work during the pendency of a bona fide dispute. Until the dispute is resolved, the associated sum shall be placed in escrow.

Subparagraph 9.6.7

DELETE Subparagraph 9.6.7 in its entirety.

Paragraph 9.7

INSERT "written" before "notice" (first sentence, fourth line).

Paragraph 9.8 – Substantial Completion
Subparagraph 9.8.1

DELETE Subparagraph 9.8.1 in its entirety and, in lieu thereof, SUBSTITUTE it with the following:

9.8.1 Substantial Completion of Project shall be deemed to occur when Architect determines and Owner approves that the Work, or designated phase thereof, is sufficiently complete in accordance with the Contract Documents so Owner can occupy and utilize the Work for its intended use, and in addition, all requirements of the Contract Documents for Substantial Completion have been fulfilled. Substantial Completion shall not have occurred unless all systems are operational, all systems have been tested and passed inspection, all facility inspections have been conducted and passed, all certifications have been posted, all personnel instruction is complete, all required finishes are in place, and any remaining work will not hamper or impair or compromise J&DR Court operations.

Subparagraph 9.8.2

DELETE the words "prior to final payment." from the third line and, in lieu thereof, SUBSTITUTE the following:

[*Substitute:*] "within 30 days of the date of Substantial Completion."

ADD new Sub-subparagraph 9.8.2.1 as follows:

9.8.2.1 Definition: Contractor's comprehensive list of items to be completed or corrected shall be referred to as the "Punch List." The Punch List shall be prepared by Contractor on the form provided in Division 1 Section "Contract Closeout", or in an electronic format acceptable to Architect, (i.e., Bluebeam, PlanGrid, etc.)

Subparagraph 9.8.5

ADD new Sub-subparagraph 9.8.5.1 as follows:

9.8.5.1 Owner's retainage upon Substantial Completion shall be the greater of (a) 5% of the Contract Sum adjusted by Change Orders, or (b) the amount necessary to protect Owner's interests, a minimum of 150% of Architect's estimated cost to complete or correct Work at the time of Substantial Completion.

Paragraph 9.10 - Final Completion and Final Payment

Subparagraph 9.10.1

INSERT "written" before the word "notice" in the first sentence.

Subparagraph 9.10.2

ADD after the words "shall become due until" in the first sentence, "Owner approves such payment and"

ADD new Subsections (7) and (8) to the end of the first sentence:

[*Add:*] "(7) Final as-built prints of record drawings marked by Contractor with record information as set forth in the Contract Documents, and (8) A final, unconditional sworn statement from Contractor duly executed and acknowledged showing all subcontractors to be fully paid and similar, final unconditional sworn statements from subcontractors and, when appropriate, from sub-subcontractors.

Subparagraph 9.10.3

INSERT "any" before "Claims" (last word in the sentence).

Subparagraph 9.10.4

ADD the following new Sub-subparagraphs:

9.10.4.5 Latent failures of Contractor to comply with the requirements of the Contract Documents.

9.10.4.6 Architect's fees resulting from re-inspections due to Contractor's failure to satisfactorily, fully and finally complete the Work or legal and accounting costs and expenses arising therefrom.

9.10.4.7 Architectural fees for services (60) days after the date of Substantial Completion shall be borne by the responsible contractor.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

Paragraph 10.2 - Safety of Persons and Property

Subparagraph 10.2.1

INSERT at the beginning of the sentence the following: "In addition to the obligations of the Contractor specified in § 3.4.3, the …."

Subparagraph 10.2.5

DELETE "(other than damage or loss insured under property insurance required by the Contract Documents)"

Subparagraph 10.2.8

INSERT "written" before "notice" in the first sentence.

ADD new Subparagraph 10.2.9 as follows:

10.2.9 Contractor shall immediately report in writing to Owner and Architect all accidents, other than minor accidents for which no medical treatment is required, arising out of, or in connection with the Work which cause death, personal injury or property damage, giving full details and statements of any witnesses whether or not Owner has actual knowledge of the accident. In addition, if death or serious personal injuries or serious damage are

caused, the accident shall be reported immediately by telephone or messenger to Owner and Architect.

Subparagraph 10.3.1

INSERT "written" after "Architect" at the end of the second sentence.

Subparagraph 10.3.3

DELETE entire subparagraph.

ADD a new Subparagraph 10.3.7 as follows:

[*Add:*] 10.3.7 Unless specifically approved by the Owner or required by the Contract, the Contractor shall not incorporate into the Work any materials containing asbestos or any material known by the industry to be hazardous to the health of building construction workers, maintenance workers, or occupants. If the Contractor becomes aware that a material required by the Contract contains asbestos or other hazardous materials, Contractor shall notify the Owner and the Architect immediately and shall take no further steps to acquire or install any such material without first obtaining Owner approval.

ADD a new paragraph 10.5 as follows:

[*Add:*] 10.5 COMPLIANCE WITH SAFETY LAWS. All phases of work under this Agreement shall conform to the applicable requirements of the Occupational Safety and Health Act (Public Law 91-956) as adopted by the U.S. Department of Labor and with the provisions of "Rules and Regulations Governing Construction, Demolition, and All Excavation", as adopted by the Safety Codes Commission of the Commonwealth of Virginia, 1966 (Amended 1970) and issued by the Department of Labor and Industry, P. O. Box 1814, Richmond, Virginia 23214.

ARTICLE 11 - INSURANCE AND BONDS

Paragraph 11.1 – Contractor's Insurance and Bonds

AMPLIFY Paragraph 11.1 – Contractor's Liability Insurance, by ADDING the following:

[*Add:*] During the term of the Contract, Contractor and each Subcontractor shall, as a minimum, and at their own cost and expense, maintain the following insurances in a company or companies properly licensed in the Commonwealth of Virginia.

1. The contractor will maintain a general liability policy with $2,000,000 combined single limits, with $4,000,000 in aggregate. Coverage is to be on an occurrence basis with an insurer licensed to conduct business in the Commonwealth of Virginia. The general liability insurance shall also include the broad form property damage endorsement, in addition to coverages for explosion, collapse, and underground hazards The insurer must have an A. M. Best rating of A- or better. The insurer must list the Owner and Architect as an additional insured. The endorsement must be issued by the insurance company. A notation on the certificate of insurance is not sufficient.

2. The contractor will maintain workers' compensation coverage in compliance with the laws of the Commonwealth of Virginia. The coverage must have statutory limits and be with an insurer licensed to conduct business in the Commonwealth of Virginia. The insurer must have an A. M. Best rating of A- or better. As an alternative, it is acceptable for the contractor to be insured by a group self-insurance association that is licensed by the Virginia Bureau of Insurance. The contractor will also carry employers liability insurance with a limit of at least $100,000 bodily injury by accident/$500,000 bodily injury by disease policy limit/$100,000 bodily injury by disease each employee.

3. The contractor will maintain automobile liability insurance with limits of at least $1,000,000. The coverage is to be written with a symbol "1". The insurer must be licensed to conduct business in the Commonwealth of Virginia. The insurer must have an A. M. Best rating of A- or better.

4. The contractor will maintain professional liability insurance with a limit of at least $1,000,000. It is preferred that the coverage be on an occurrence basis. If the policy is on a claims made basis, this should be noted. If the contractor has professional liability insurance on a claims made basis, agreement must be made that coverage will be maintained for at least three years beyond the expiration date of the policy in force at the time of this contract. Coverage is to be with a company licensed to conduct business in the Commonwealth of Virginia and have an A. M. Best rating of A- or better. The Owner and Architect should be listed as an additional insured on the policy. The endorsement must be issued by the insurance company. A notation on the certificate of insurance is not sufficient. (NOTE: This is only needed when professional services are being conducted by the contractor. For example if the contractor is providing professional advice or design work, the professional liability coverage should be required.)

5. The contractor will maintain a surety bond in an amount not less than the total amount payable to the contractor for the terms of this contract. The bond will be issued by a company licensed to issue surety bonds in the Commonwealth of Virginia and has an A. M, Best rating of A- or better.

   With all policies listed above, the insurer or agent of the insurer must issue a certificate of insurance to show evidence of coverage. To the extent commercially and reasonably available, all wording limiting the insurer responsibility to notify the Owner and Architect of any cancellation or non-renewal of the coverage must be removed.

Subparagraph 11.1.2

ADD the following new sentence to the end of Subparagraph 11.1.2:

[*Add:*] Where Owner's and Contractor's/Subcontractor's policies each apply, Contractor's/ Subcontractor's policies shall be considered primary.

Subparagraph 11.1.3

ADD "to the extent such a provision is commercially and reasonably available" to the end of the second sentence.

Paragraph 11.3 - Property Insurance

Subparagraph 11.3.1

DELETE Subparagraph 11.3.1 in its entirety, and SUBSTITUTE the following:

[*Substitute:*] **CONTRACTOR TO PROVIDE BUILDERS RISK POLICY.** The Contractor shall purchase and maintain, from a company or companies lawfully authorized to do business in the Commonwealth of Virginia, property insurance written on a builder's risk "all-risk" or equivalent policy “completed value” form in the amount of the total value for the entire Project at the site on a replacement cost basis. The limit will be the full replacement cost of the building and/or structures being built under this Agreement. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Architect, the Contractor, Subcontractors and Sub-subcontractors in the Project. The City of Staunton, VA will be listed as an insured under this policy to protect any property owned at the construction site. Coverage is to be with a company that has an A. M. Best rating of A- or better. Policies shall be written to include the names of Contractors and Owner "as their interest may appear", and all insurance shall be in effect on or before the date when construction work is to commence. The insurance to be furnished by the Contractor under this subparagraph will include a deductible of One Thousand dollars ($1,000.00) per occurrence on all perils of loss with the exception of Flood and Earthquake subject to the insurance policy forms and exclusions. The deductible shall be paid by the Contractor, or contractor(s) in proportion to their respective portions of loss, if the loss affects more than one (1) Contractor or subcontractor.

DELETE the phrase “shall be on an ‘all-risk’ or equivalent policy form and” from Sub-subparagraph 11.3.1.1. ADD the following at the end of Subparagraph 11.3.1.1:

[*Add:*] The insurance to be provided hereunder shall include coverage for materials and equipment accepted for incorporation into the completed Project and stored on the site of the Work, stored in an off-site location, or in transit. The insurance to be furnished by the Contractor under this paragraph 11.3 will cover only those materials and equipment which will become a permanent part of the completed project and scaffolding, construction forms and temporary structures if their values are chargeable to the project.

DELETE Sub-subparagraphs 11.3.1.2, 11.3.1.3, and 11.3.1.4 in their entirety, and REPLACE them with the following Sub-subparagraphs:

11.3.1.2 Following any loss which the Contractor believes may be covered by the insurance to be provided under this subparagraph 11.3.1, the Contractor shall immediately notify the insurance company and the Owner. The Contractor will report to the insurance company losses on behalf of the Owner. The Contractor shall cooperate with the Owner and the insurer, or its authorized representatives, in their efforts to investigate and settle the claim, including providing any and all requested information, documentation and reports and providing safe access to the site for inspection. Contractors’ failure to provide timely notification of loss to the Owner, or Contractors’ failure to provide requested and adequate information or documentation, shall not prejudice the Owner in any manner whatsoever.

11.3.1.3 The Contractor is responsible for notifying law enforcement or other applicable authorities in the event of a loss and for compiling all pertinent and required information in a timely manner.

11.3.1.4 Following a loss, the Contractor shall immediately take all necessary and reasonable steps to protect the property from further damage or loss.

ADD the following language to the end of Subparagraph 11.3.3:

[*Add:*] "Owner's loss of use damages are limited to the amount paid under the Loss of Use policy. Contractor and all subcontractors shall be named as additional insureds on Owner's Loss of Use policy, to the extent such an endorsement is available."

DELETE Subparagraph 11.3.7 in its entirety.

Subparagraph 11.3.8

DELETE the words "as fiduciary" whenever they appear.

Subparagraph 11.3.9

DELETE the words "as fiduciary" whenever they appear.

Subparagraph 11.3.10

DELETE the words "as fiduciary".

ADD new Subparagraphs 11.3.11 and 11.3.12 as follows:

[*Add:*] 11.3.11 The Owner reserves the right to choose and determine the manner in which any damaged work covered by the insurance provided hereunder shall be replaced or repaired and the extent to which replacement or repair shall be accomplished. In the event the Owner chooses not to replace or repair damaged Work, or chooses to have repairs or replacement accomplished by others, the Contractor(s) shall be paid in full by the Owner for the actual value of all Work accomplished on the affected portion of the damaged facility prior to the time of the loss. The Contractor(s) shall not have any claim or be entitled to any payment, including loss of profit, for the value of lost or uncompleted Work. Nor shall any provision in anyway release the Contractor or the Contractor's surety from obligations under the Contract to fully complete the undamaged portions of the Project. In the event the Owner chooses to have the repair or replacement of the damaged work performed under this Agreement, said work shall be paid for and accomplished in accordance with the Change Order provisions of this Contract.

[*Add:*] 11.3.12 The Owner assumes no liability, and the Contractor shall have no claim against Owner, for the amount of loss claimed by the Contractor which exceeds the actual proceeds received from the Insurance provided hereunder. The Contractor shall have no claim against the Owner for any loss caused by perils not covered by the insurance provided by the Contractor

hereunder, nor shall the Contractor have any claim against Owner for any loss to Contractor's materials, tools, equipment or personal property not covered by the said insurance. All costs incurred by the Contractor associated with the loss not covered by an insurance loss settlement shall be borne by the Contractor."

Paragraph 11.4 - Performance Bond and Payment Bond
Subparagraph 11.4.1

DELETE Subparagraph 11.4.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

11.4.1

Contractor shall provide bonds in accordance with the provisions of the Contract Documents and the Commonwealth of Virginia – VPPA, and in so doing shall provide:

(a) A Performance Bond at one hundred percent (100%) of the Contact amount, conditioned upon the faithful performance of Contractor in strict accordance with the plans, specifications and conditions of the Contract. Such bond shall be solely for the protection of Owner or assignee as authorized in accordance with the provisions of Paragraph 13.2.1 herein.

(b) A Payment Bond at one hundred percent (100%) of the Contract amount. Such bond shall be solely for the protection of claimants supplying labor or materials to Contractor or to any of their Subcontractors in the prosecution of the Work provided for in the Contract Documents and shall be conditioned for the prompt payment of all such material furnished or labor supplied or performed in the prosecution of the Work. "Labor or Materials" shall include public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the site.

(c) Each of such bonds required by the Contract Documents shall be executed by one or more surety companies legally authorized to do business in the Commonwealth of Virginia and not otherwise objectionable to Owner. The surety of whom Contractor has purchased bonds shall have an "A-" or better rating, plus a financial rating of VI or better with the A. M. Best's Company (Key Rating Guide – Latest Edition) and listed in the Department of Treasury Circular 570, with a capacity which meets or exceeds the contract amount. The bond shall be payable to Owner or assignee as provided for in Paragraph 13.2.1

Both a Performance Bond and Payment Bond shall be required as specified under Article 7 of the Supplementary Instructions to Bidders.

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK
Paragraph 12.2 - Correction of Work
Subparagraph 12.2.2 After Substantial Completion
Sub-subparagraph 12.2.2.1

DELETE the following from the first sentence and, in lieu thereof, SUBSTITUTE the following:

[*Delete:*] "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"

[*Substitute:*] "if, within one (1) year after the date of Final Completion of the Work or within one (1) year from the date of Partial Occupancy and Use and Final Completion of designated phases thereof (whichever shall first occur) or after the date for commencement of warranties"

DELETE sub-subparagraph 12.2.2.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new sub-subparagraph:

12.2.2.3 In the event any Work, material or equipment is replaced or repaired as a consequence of latent defects or failure to meet the terms of the Contract Documents, all warranties with respect to such Work, material or equipment replaced or repaired shall continue following repair or replacement of such Work, material or equipment for an additional period equivalent to the original period of warranty for such Work, material or equipment.

ADD new subparagraphs 12.2.6 and 12.2.7, as follows:

[*Add:*] 12.2.6 In any case, when in fulfilling the requirements of the Contract Documents and this guarantee or any other guaranty or warranty, the Contractor disturbs any work performed by a separate contractor, Contractor shall restore such work to a condition satisfactory to the Architect and Owner and guarantee such restored work to the same extent as if it was guaranteed under this Agreement. In the event the Work of the Contractor is to be modified by another contractor, either before or after the final inspection, the Contractor shall remain responsible in all respects under this paragraph's warranty and under any other warranties or guarantees, express or implied, applicable to or arising from this Agreement or by law. However, the Contractor shall not be responsible for any defects in material or workmanship introduced by the contractor modifying Contractor's Work. The Contractor and the contractor making the modifications shall each be solely responsible for their own respective work. The contractor modifying the earlier Work shall be responsible for any damage to or defect introduced into the Work by its modification. If Contractor claims that a subsequent contractor has introduced defects of materials and/or workmanship into Contractor's Work, Contractor shall bear the burden of making the claim to demonstrate clearly the nature and extent of such introduced defects and the other contractor's responsibility for those defects.

[*Add:*] 12.2.7 The warranties of this paragraph shall be in addition to and not in lieu of all other warranties, express or implied, applicable to or arising from this Agreement or by law.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

Paragraph 13.1 – Governing Law

DELETE the second sentence.

Subparagraph 13.3.2

REPLACE "the Owner, Architect or Contractor" with "Owner or Architect"

Paragraph 13.4 - Tests and Inspections

Subparagraph 13.4.1

DELETE Subparagraph 13.4.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new subparagraph:

13.4.1 If the Contract Documents or any laws, statutes, ordinances, building codes, rules, regulations or orders of any governmental body or public or quasi-public authority having jurisdiction over the work or the site of the Project require any portion of the Work to be inspected, tested or approved, Contractor shall give Architect and Owner timely notice thereof so Architect and Owner may observe such inspection, test or approval.

Subparagraph 13.5 – Interest

DELETE Subparagraph 13.5 in its entirety.

ADD new Paragraph 13.6 as follows:

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT
Paragraph 14.1 - Termination by the Contractor

DELETE Paragraph 14.1 in its entirety.

Paragraph 14.2 - Termination by the Owner for Cause
Subparagraph 14.2.1

DELETE Subparagraph 14.2.1 in its entirety and, in lieu thereof, SUBSTITUTE the following:

14.2.1 Owner may terminate the Contract if Contractor:

.1 shall institute proceedings or consent to proceedings requesting relief or arrangement under the Federal Bankruptcy Code or any similar or applicable federal or state law; or if a petition under any federal or state bankruptcy or insolvency law is filed against Contractor and such petition is not dismissed within sixty (60) days from the date of said filing; or if Contractor admits in writing, its inability to pay its debts generally as they become due, or if it makes a general assignment for the benefit of its creditors, or if a receiver, liquidator, trustee or assignee is appointed on account of its bankruptcy or insolvency; or if a receiver of all or any substantial portion of Contractor's properties is appointed.

.2 abandons the Work; or if it fails, except in cases for which an extension of time is provided, to prosecute promptly and diligently the Work or to supply enough properly skilled workers or proper materials for the Work;

.3 submits an Application for Payment, sworn statement, affidavit or document of any nature whatsoever which is intentionally falsified;

.4 fails to make prompt payment to subcontractors or for materials or labor or otherwise breaches their obligations under any subcontract with a subcontractor; or if a materialman's lien or notice of lien is filed against any part of the Work or the site of the Project and not promptly bonded or insured over by Contractor in a manner satisfactory to Owner;

.5 disregards any laws, statutes, ordinances, rules, regulations or orders of any governmental body or public or quasi-public authority having jurisdiction of the Work or the site of the Project;

.6 otherwise violates any provision of the Contract Documents; then Owner, upon the occurrence of the events described in clauses .1 through .6 above, without prejudice to any right or remedy available to Owner under the Contract

Documents or at law or in equity may, after giving Contractor and its surety under the Performance Bond and under the Labor and Material Payment Bond, if any, seven (7) days written notice, terminate the Contract and, in accordance with the Uniform Commercial Code, may enforce a Security Agreement by taking possession of and using all or any part of Contractor's materials, equipment, supplies and other property of every kind used by Contractor in the performance of the Work in the completion of the Work. If requested by Owner, Contractor shall remove any part or all of its equipment, machinery and supplies from the site of the Project within seven (7) days from the date of such request, and in the event of Contractor's failure to do so, Owner shall have the right to remove or store such equipment, machinery and supplies at Contractor's expense. In case of such termination, Contractor shall not be entitled to receive any further payment for Work performed by the Contractor, whether before, on, or after the date of termination, except as described in paragraph 14.2.4 below. Owner's right to terminate Owner-Contractor Agreement pursuant to this Subparagraph 14.2.1 shall be in addition to and not in limitation of any rights or remedies existing hereunder or pursuant hereto or at law or in equity.

Subparagraph 14.2.4

DELETE Subparagraph 14.2.4 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph 14.2.4:

14.2.4 If the unpaid balance of the Contract Sum exceeds all costs to Owner of completing the Work, then Contractor shall be paid for all Work performed by Contractor to the date of termination. If such costs to Owner of completing the Work exceed such unpaid balance, Contractor shall pay the difference to Owner upon Owner's demand. The costs to Owner of completing the Work shall include, but not be limited to, the cost of any additional architectural, legal, consulting, expert, managerial and administrative services required thereby, any costs incurred in retaining another contractor or other subcontractors, any additional interest or fees which Owner must pay by reason of a delay in completion of the Work, including attorneys' fees and expenses and any other damage, costs and expenses Owner may incur by reason of completing the Work. The amount, if any, to be paid to Contractor shall be certified by Architect upon application, in the manner provided in Paragraph 9.4, and this obligation for payment shall survive the termination of the Contract.

Paragraph 14.3 - Suspension by the Owner for Convenience
Subparagraph 14.3.1

ADD the following new sentence to the end of Subparagraph 14.3.1:

[*Add:*] Any suspension by Owner for convenience does not constitute grounds for termination by Contractor.

Subparagraph 14.4.3

DELETE the remainder of the subparagraph after the words "for Work properly executed."

ADD new Paragraph 14.5 as follows:

Paragraph 14.5 IP Indemnification

14.5 Contractor and each subcontractor shall indemnify defend and hold harmless, Owner, its officers, directors, agents, and employees, Architect and its officers, directors, agents and employees, and each of them, as "indemnitee", from and against any and all fines, penalties, losses, costs, damages, injuries, expenses, claims, liens, encumbrances and/or liabilities (individually and collectively referred to herein as "liabilities") arising out of, or resulting from any claim that any service or goods that the Contractor supplied allegedly infringed, including without limitation any patent, copyright, trademark, service mark, trade secret or other legally-protected proprietary right. Owner shall notify Contractor of any suit or legal proceeding asserting a claim for liabilities described in this paragraph. Contractor and subcontractors shall, at no cost to any indemnitee, defend and/or settle such suit or legal proceeding, or judgment, including any appellate proceeding, asserting a claim for liabilities. Contractor and subcontractors shall pay any costs and legal fees incurred by any indemnitee in connection with any liabilities, whether or not litigation is actually commenced, and shall keep indemnitiees informed as to the progress of the defense. If requested by an indemnitee, Contractor and subcontractors shall afford indemnities the opportunity to participate in the defense or settlement of any claim at their own cost or expense. With regard to any claim of infringement as referred to herein, Contractor and Subcontractors shall procure the right to continue using the services or goods, or at the indemnitiees' option, replace or modify the services or goods to make them non-infringing services or goods.

ARTICLE 15 – CLAIMS AND DISPUTES
Paragraph 15.1 - Claims
Subparagraph 15.1.1 - Definition

ADD the following new sentence to the end of Subparagraph 15.1.1:

[*Add:*] All Claims as defined in §15.1.1, and any other claim or dispute between and among Contractors, or any Contractor and Owner or Architect, shall be governed by this Article 15.

Subparagraph 15.1.2

DELETE "Substantial" and substitute "Final" before "Completion" and INSERT "or as otherwise allowed by applicable law, whichever is later" after "Work" in the first sentence.

Subparagraph 15.1.3 – Notice of Claims

INSERT "written" before "notice" in the first sentence.

Sub-subparagraph 15.1.4.2

Change "shall" to "may".

Subparagraph 15.1.7 – Waiver of Claims for Consequential Damages

DELETE Subparagraph 15.1.7, including both sub-subparagraphs, in its entirety, and in lieu thereof, SUBSTITUTE the following subparagraph:

15.1.7 Contractor waives Claims against Owner for consequential damages arising out of or relating to this Contract, including but not limited to waiving any claims for damages incurred by Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit.

Subparagraph 15.1.8 – Owner as a Contracting Body

ADD new Subparagraph 15.1.8 as follows:

15.1.8 Contractor agrees and acknowledges that Owner is a public body corporate and a political subdivision of the Commonwealth of Virginia, and the Work on the Project is public construction and not subject to the filing of Mechanics Liens, and further agrees to provide and specify in its subcontracts with subcontractors for their acknowledgment that their sole remedy as to payment for the performance of labor or the furnishing of materials exists only under the provisions of the Payment Bond.

Subparagraph 15.2.5

DELETE in the third sentence after "parties" the following: "but subject to mediation, and if the parties fail to resolve their dispute through mediation, to binding dispute resolution."

Subparagraphs 15.2.6, 15.2.7, 15.2.8

DELETE in their entirety the following: 15.2.6, 15.2.7, and 15.2.8. SUBSTITUTE a new Subparagraph 15.2.6 as follows:

[*Substitute*:] 15.2.6 Nothing in this Article 15 shall prohibit Owner from seeking equitable relief in a court of appropriate jurisdiction referenced in paragraph 15.3, without a decision of the initial decision maker, in an emergent circumstance where the initial decision maker cannot provide relief to the Owner.

Paragraph 15.3

DELETE in its entirety the provisions of paragraph 15.3 and SUBSTITUTE the following provisions:

Paragraph **15.3 Forum Selection; Waiver of Jury Trial**

15.3.1 Binding dispute resolution shall be in a court of competent jurisdiction. All actions, suits, or proceedings of any nature under the Contract or related in any way to the Project or the actions or omissions of the Contractor, Owner, or Architect as between or among any of them shall be filed and maintained solely in the Circuit Courts of the City of Staunton, Virginia, or, if federal jurisdiction exists, in the United States District Court for the Western District of Virginia, at Harrisonburg. If any action suit or proceeding is brought by the Contractor solely against the Architect, the Architect may elect to require the dispute to be the subject of mediation and, absent resolution through mediation may then elect to require the dispute to be the subject of

and decided by arbitration, pursuant to the rules of the American Arbitration Association; however, neither the Architect nor the Contractor, as a condition to the Architect electing the foregoing, shall have and they each expressly waive the right to assert at any time under any circumstances any third-party claim against or to join the Owner in such proceedings.

15.3.2 Contractor, Owner, and Architect waive any and all rights to trial by jury.

15.3.3 Should any Contractor bring a claim against Owner or Architect, then, unless the fact finder finds that Contractor had a good faith basis for the claim against Owner or Architect, Contractor shall be liable to Owner and Architect for all of Owner's and Architect's costs in having all such claims dismissed, or in defending all such claims, or both. These costs shall include all of Owner's or Architect's costs, including without limitation personnel costs, attorney's fees, expert fees, consulting fees, travel expenses, compensation expenses of staff and all other attributable costs.

Paragraph 15.4

DELETE paragraph 15.4 in its entirety, and SUBSTITUTE the following:

[*Substitute*:] 15.4 REQUIRED STATE LAW PROVISION REGARDING CONTRACTOR CLAIMS AGAINST OWNER. Contractual claims against the Owner, whether for money or other relief, shall be submitted in writing no later than 60 days after final payment. However, written notice of the Contractor's intention to file a claim shall be given at the time of the occurrence or beginning of the work upon which the claim is based. Timely submission of the claim to the Initial Decision Maker shall constitute compliance with the foregoing sentence. Notwithstanding any other provision herein, the Contractor may not proceed to litigation against the Owner except in accordance with the provisions of this Article 15, and, in addition, without submitting its claim against the Owner to the Clerk of the Works, as the designee of the Owner for consideration and evaluation pursuant to the provisions of Virginia Code § 2.2-4363(C), which are expressly incorporated herein by reference and made part hereof. Contractor may not institute legal action as provided in § 2.2-4364, prior to receipt of the Clerk of the Works decision on the claim, unless the Clerk of the Works fails to render such decision within the time provided by § 2.2-4363(C). A failure of the Clerk of the Works to render a final decision within the time provided shall be deemed a final decision denying the claim by the City of Staunton. The decision of the Clerk of the Works shall be final and conclusive unless the Contractor appeals within six months of the date of the final decision on the claim by the Clerk of the Works by invoking by instituting legal action as provided in § 2.2-4364."

ADD new Paragraph 15.5 as follows:

15.5 - Scheduling and Completion

15.5.1 It is the intention of the parties through these Contract Documents that all claims between Contractors arising from or related to coordination and scheduling of the Work,

and any delays, disruptions, or interferences arising from or related to the actions of Contractors, shall be resolved between or among Contractors. Specifically, by execution of the Agreement, Contractor agrees to the following:

.1 Owner and Architect and their representatives are not responsible for delays arising from or related to any act or omission of any Contractor. Owner and Architect are not responsible for any costs or damages arising from or related to a Contractor's coordination and scheduling of its Work. Owner and Architect are not liable for any costs or damages suffered or claimed by a Contractor arising from or related to any Contractor's coordination of its Work. Contractor hereby waives and releases and shall indemnify defend and hold harmless Owner and Architect from any liability and damages arising from or related to coordination by a Contractor of the Work, or coordination of the Work between or among Contractors, including their subcontractors and suppliers.

.2 Architect and Owner and their representatives shall not be liable to a Contractor for any increased costs or damages for defective work, interference, or delays arising from or related to any conflict between or among Contractors, their subcontractors and suppliers. Neither Owner nor Architect shall be joined as a party to any disputes or actions between or among Contractors or their subcontractors and suppliers concerning such additional expense or damage. Contractor's exclusive remedy in this regard shall be against any other Contractors involved in the dispute. Should any Contractor attempt to join Owner or Architect in any proceeding arising from any Claim between Contractors, including its subcontractors and suppliers, Contractor attempting to join Owner and Architect shall be liable to Owner and Architect for all of Owner's and Architect's costs arising from or related to such claims, including without limitation, seeking to have all such claims dismissed, or in defending all such claims, or both. These costs shall include all of Owner's or Architect's costs, including without limitation personnel costs, attorney's fees, expert fees, travel expenses, and the like.

.3 It is agreed by all parties that disputes or actions between Contractors concerning any additional expense or damage herein mentioned above shall not delay completion of the Work, which shall be continued by the parties pending final resolution of a claim, including without limitation, judicial proceedings. All final construction decisions of the Lead Prime Contractor, regarding scheduling and coordination of the Work, whether rendered orally or in writing, shall be observed and followed fully.

.4 It is agreed by the parties to this Contract that the intent of this Paragraph 15.5.1 is to benefit Owner and Architect, and Owner's interests, and that the provisions of the Contract Documents shall raise Contractor and other Contractors to the status of third party beneficiaries in connection with the coordination and scheduling of the Project and related claims between or among Contractors, and for no other purpose. Each Contractor hereby waives privity of Contract defenses as to other Contractors, and any assertion that Owner or Architect is vicariously or otherwise responsible for the acts and omissions of other Contractors. Each Contractor agrees that the other Contractors have the right to file claims and litigation against Contractor in the event Contractor is alleged to have caused damage to another Contractor by reason of delay, disruption, interference, or lack of coordination, among other reasons, as more fully described in the Contract Documents.

.5 Contractor specifically releases, foregoes and waives any claims against Owner or Architect for extended overhead, delay damages, “impact” damages, loss of efficiency, loss of productivity, lost profit, or any other similar form of loss, damage or compensation, or other damages related to coordination and scheduling of the Project and all delays, disruptions, and interferences caused by the other Contractors.

15.5.2 Claims Related to Project Delay, Acceleration, Hindrances, Loss or Productivity or Similar Damages

As stated above in Subparagraphs § 3.3.4, § 6.1.3 and § 8.3.3, Contractor shall not pursue any claim for money damages against Owner, Architect, Owner’s Representative (or their respective directors, employees or agents) in the event of any project delay, acceleration, hindrances, loss of productivity or similar damages, but shall be entitled to pursue a claim or dispute resolution proceeding for money damages against any other responsible Contractor pursuant to this Article 15. Each Contractor acknowledges it may be subject to third-part beneficiary claims and litigation brought by other Contractors for money damages as stated above, and expressly waives any privity of contract defense with regard to such proceedings. Each Contractor further agrees it will not bring Owner, Architect, Owner’s Representative (or their respective directors, employees or agents) into any such claim or litigation proceedings as a party thereto, and will be subject to the indemnification provisions of Subparagraph § 8.3.3 if it violates this commitment.

END OF SECTION 000750

1.5 SUBMITTALS

A. For those submittals, close-out documents and O&M manuals requiring review by the engineer's consultants, contractor shall ship such documents to the engineer.

1.6 CORRELATION OF CONSTRUCTION DOCUMENTS

A. Review construction documents thoroughly prior to the start of construction.

B. Report any conflict or discrepancy discovered in the Construction Documents to the Engineer prior to the start of construction.

C. Report any conflict or discrepancy discovered between the Construction Documents and state and local governmental regulations to the Engineer prior to the start of construction.

1.7 PROJECT CONDITIONS

A. The conditions existing at the time of inspection for bidding purposes will be maintained by the Owner to the extent practical. However, minor variations may occur due to Owner's removal and salvage operations prior to the start of demolition work.

B. The location of existing underground utilities indicated is approximate only. Field locate all existing underground utilities in the area of work, regardless of whether or not they are indicated. Call "Miss Utility" prior to the start of demolition work for assistance in the location of existing underground utilities.

C. Should charted, uncharted or incorrectly charted utilities be encountered during demolition, contact the engineer immediately for instructions. Cooperate with Owner and utility companies to keep services and facilities in operation.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PROJECT CLEAN UP

A. Clean site as construction progresses. Do not allow trash or other waste materials to accumulate.

B. Prior to requesting the punch-list inspection, clean the site to the following requirements:

1. Power wash all walks and pavements.
2. The remainder of the site shall be broom clean.
3. Remove all trash and debris.

3.2 EXISTING FACILITIES

A. Preserve existing signs, markers, guardrails and fences in their original condition unless written permission is obtained for their removal and replacement.

B. Replace damaged items at no additional cost to the Contract.

END OF SECTION

SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: City of Staunton - Juvenile and Domestic Relations Courthouse.

B. Owner's Name: City of Staunton, Virginia.

C. Architect's Name: Moseley Architects of Richmond, VA.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price (Fixed Sum) as described in the Bidding and Contractual Requirements (Division 00) included in this Project Manual.

1.03 PROFESSIONAL SEALS

A. Use of Professional Seals on Bidding, Procurement, and Contract Documents: For the purposes of this paragraph, the term “Regulant” refers to the individual who signs and seals parts of the Contract Documents (e.g. the Drawings and Specifications). Certain information has been excerpted verbatim from a source or sources (e.g., UL assemblies, SMACNA details, applicable state/jurisdiction building code) which was considered or used by Regulant in preparing parts of the Contract Documents, as follows:

1. The excerpted information was neither prepared under the direct control nor personal supervision nor created by the Regulant, as it was prepared by the source and owner of the excerpted information.
2. For purposes of bidding, procuring, and performance of the Work, and in any event of conflicts or ambiguities between the excerpted information in the Contract Documents and the requirements of applicable codes and standards, provide the better quality or greater quantity of Work which, at a minimum, complies with the requirements of the applicable codes and standards.
3. Advise Architect immediately upon becoming aware of requirements of the Work which are not consistent with the requirements of the excerpted information.
4. Attribution is acknowledged for information obtained and included herein verbatim from other source or sources.
5. Regulant has taken into consideration and used certain excerpted information from other sources which are applicable to the Contract Documents, and the Regulant indicates by its seal that it is assuming responsibility for its services in use and application of the excerpted information to the requirements of Work, but not for the excerpted information itself which was prepared by others. Regulant does not indicate by its seal that it is responsible for use or application of other information in such source or sources which was not included herein.

1.04 OWNER OCCUPANCY

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

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

C. Schedule the Work to accommodate Owner occupancy.

1. Maintain routes of egress and life safety systems for Owner and occupants at all times.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

1. Locate and conduct construction activities in ways that will limit disturbance to site.

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

C. Existing building spaces may not be used for storage.

D. Existing building shall be maintained weathertight. Do not modify elements of the existing building except as indicated on the Construction Documents. Repair damage to the existing building due to construction activity.

E. Time Restrictions:
   1. Comply with local regulations for hours of work, noise ordinances, and similar requirements.

F. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   2. 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 Owner and authorities having jurisdiction.
   3. Prevent accidental disruption of utility services to other facilities.

G. Controlled Substances: The use of alcohol and drugs is not permitted on the Project site. Provide a designated outdoor smoking area for construction personnel that is at least 30 feet away from the building.

1.06 SPECIFICATION SECTIONS APPLICABLE TO ALL WORK

A. The provisions of the Owner/Contractor agreement, General Conditions of the Contract, Supplementary Conditions (if any), and all Division 01 sections shall apply to all sections of the Project Manual.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 011000

SECTION 012000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

1.02 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, unless otherwise agreed to by Owner in writing.

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

C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.

D. Include in each line item, the amount of Allowances specified in this section. For Quantity Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

E. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

F. Revise schedule to list approved Change Orders, with each Application For Payment.
   1. When a Change Order includes multiple PCOs, break down the total Change Order to include each PCO as an individual line item.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Use Form AIA G702 and Form AIA G703.

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

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

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

F. Execute certification by signature of authorized officer.

G. 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.

H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
   1. When a Change Order includes multiple PCOs, break down the total Change Order to include each PCO as an individual line item.

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

J. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 013000.
   2. Construction progress schedule, revised and current as specified in Section 013000.
   3. Partial release of liens from major subcontractors and vendors.
   4. Affidavits attesting to off-site stored products.

1.04 MODIFICATION PROCEDURES

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

B. 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 with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 14 days, unless otherwise indicated in Proposal Request.

C. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation.

D. For other required changes, Architect will issue a Construction Change Directive, on AIA Document G714, signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
   3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.

F. Substantiation of Costs: Provide full information required for evaluation.
   1. Provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

G. Execution of Change Orders: Architect will issue Change Orders on AIA Document G701 for signatures of parties as provided in the Conditions of the Contract.

H. 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.

I. 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.

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 017000.

C. Provide evidence and supporting data for the following, as attachments to the Application for Final Payment:
   1. AIA G706, "Contractor's Affidavit of Payment of Debts and Claims."
   2. AIA G707, "Consent of Surety to Final Payment."
   3. Settlement of all debts and claims, including liquidated damages, taxes, and fees.
   4. Utility meter readings, fuel levels, and similar measurements, as of the date of turn over to the Owner.
   5. Certificates for insured products.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012000

SECTION 012100
ALLOWANCES

PART 1 GENERAL

1.01 SUBMITTALS

A. Allowance Proposal: Submit initial proposal for purchase of products and materials, on Change Order form.

B. Supporting Documentation:

1. Products and Material: Provide invoices and other documents as required, for products and materials indicating quantities, prices, taxes, delivery fees, and other costs.
2. Labor and Installation: Provide time sheets and other documents as required, indicating all on-site Subcontractor costs, including hours worked, quantity or amount of product/material installed, hourly wages, and Subcontractor overhead and profit.

1.02 LUMP-SUM AND QUANTITY ALLOWANCES

A. Costs Included in Lump-Sum and Quantity Allowances: All Subcontractor's costs: Cost of products and materials, taxes, freight, delivery, receiving and handling, labor and installation, Subcontractor overhead and profit.

B. Costs Not Included in Lump-Sum and Quantity Allowances: All General Contractor's costs: General coordination, GC's overhead and profit.

C. Contractor Responsibilities:

1. Assist Architect in selection of products.
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.

D. Differences in costs will be adjusted by Change Order.

1.03 LUMP SUM ALLOWANCE SCHEDULE

A. Lump Sum Allowance No. 1: Include the stipulated sum of $50,000 for interior and exterior panel signage, as specified in Division 10 Section "Signage."

1.04 QUANTITY ALLOWANCE SCHEDULE

A. Quantity Allowance No.. 1: Include 20,000 square feet of moisture vapor treatment (MVT). Coordinate with Division 1 "Unit Prices" for unit price requirements that will be used to determine allowance adjustments.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012100

SECTION 012200
UNIT PRICES

PART 1 GENERAL

1.01 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.02 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.03 MEASUREMENT OF QUANTITIES

A. Measurement methods delineated on the Drawings or in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the Drawings or individual specification section govern.

B. Take all measurements and compute quantities. Measurements and quantities will be verified via mutual agreement, and by personnel authorized by Owner, if required.

C. Assist by providing necessary equipment, workers, and survey personnel as required.

D. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.

E. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes; calculate and certify quantities for payment purposes.

1.04 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

B. Payment will not be made for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from the transporting vehicle.
   4. Products placed beyond the lines and levels of the required Work.
   5. Products remaining on hand after completion of the Work.
   6. Loading, hauling, and disposing of rejected Products.

1.05 SCHEDULE OF UNIT PRICES

A. Unit Price 1: Moisture Vapor Treatment (MVT):
   1. Unit Price shall cover providing a surface-applied moisture vapor treatment, to be applied to concrete slabs prior to installation of floor finishes. Unit price shall be measured by the square foot (sq. ft.). This unit price shall be provided in coordination with Quantity Allowance; refer to Allowances section for more information.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012200

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control, such as unavailability, regulatory changes, or unobtainable warranty terms.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.

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 Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.
   6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

C. Substitutions shall be submitted directly by a General Contractor/prime bidder. Substitutions submitted by a subcontractor, manufacturer, supplier or other entity other than General Contractor are not acceptable and shall be rejected.

D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. A copy of the Substitution Request Form that shall be used is included at the end of this Section for informational purposes. Request a Word or editable PDF version of the form from the Architect and complete the form digitally; do not complete the form by hand.
   2. Contractor's Substitution Request documentation must include the following:
      a. Substitution Request Information:
         1) Indication of whether the substitution is for cause or convenience.
         2) Issue date.

3) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
4) Description of Substitution.
5) Reason why the specified item cannot be provided.
6) Description of how proposed substitution affects other parts of work.

b. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
1) Physical characteristics.
2) In-service performance.
3) Expected durability.
4) Visual effect.
5) Sustainable design features.
6) Warranties.
7) Other salient features and requirements.
8) Include, as appropriate or requested, the following types of documentation:
(a) Product Data:
(b) Samples.
(c) Certificates, test, reports or similar qualification data.
(d) Drawings, when required to show impact on adjacent construction elements.

c. Impact of Substitution: Provide data indicating cost savings to Owner and change in Contract Time due to accepting substitution.

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 CONSTRUCTION

A. Architect will consider requests for substitutions for convenience only within 30 days after date of Agreement.
1. Substitutions for convenience submitted after this time period may or may not be considered, at the Architect's discretion.

B. Submit request for Substitution for Cause immediately upon discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
3. Bear the costs engendered by proposed substitution of:
a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
b. Other unanticipated project considerations.

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.

3.03 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.

3.04 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.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

END OF SECTION 012500

MOSELEYARCHITECTS

Substitution Request Form – After Receipt of Bids

All Substitution Requests shall be submitted by the Contractor only. Substitution Requests received from subcontractors, sub-subcontractors, manufacturers, vendors, etc., will be "rejected" without review.

General Information				
Project Name	Staunton J&DR Courts Facility			
A/E Project Number	630874			
Specified Product/Item Information				
Specification Title				
Section				
Page				
Article / Paragraph				
Description				
Proposed Substitution Information				
Proposed Substitution				
Reason for not providing specified product/item				
Comparative Data	Attach a point-by-point comparative data list. Include all differences between the proposed substitution and the specified product/item. If not provided, this Request will be rejected.			
Manufacturer				
Manufacturer Address				
Manufacturer Phone				
Manufacturer Representative Email address				
Trade / Model Name				
Model Number				
Installer				
Installer Address				
Installer Phone				
History	☐ New product	☐ 2-5 years	☐ 5-10 yrs	☐ 10 yrs or longer
Proposed substitution affects other parts of the Work	☐ Yes		☐ No	
If yes, explain				
Savings to Owner for accepting proposed substitution	$			
Proposed substitution affects Contract Time	☐ Yes		☐ No	

If yes	☐ Add	☐ Deduct
If yes, number of calendar days		
Proposed Substitution Similar Installation		
Have you (this Contractor) used this product/item on any other projects	☐ Yes	☐ No
Project		
Project Address		
Architect/Engineer		
A/E Phone		
Owner		
Owner Phone		
Date installed		

Attached Supporting Data					
☐ Drawings	☐ Product Data/Specs	☐ Samples	☐ Tests	☐ Reports	☐

Contractor certifies all of the following:
• Contractor shall provide specified product/item in the event this Substitution request is rejected. • Proposed substitution has been fully investigated and determined to be equal or superior in all respects to the specified product, except as may otherwise be specifically and clearly indicated herein. • If applicable, proposed substitution shall not adversely affect LEED requirements nor shall it prevent achieving the relative number of applicable LEED point[s] the specified product would have received. • Proposed substitution's function, appearance, and quality are equal or superior in all respects to the specified product, except as may otherwise be specifically and clearly indicated herein. • Same or superior warranty and/or guarantees shall be furnished for proposed substitution as is required for the specified product/item. • Same maintenance service and source replacement parts, as applicable, are available; including local availability. • Proposed substitution shall have no adverse effect on other trades. • Cost data as stated herein is complete. Claims for additional costs related to the accepted proposed substitution which may subsequently become apparent shall be waived; including licenses, fees, and/or royalties. • Proposed substitution shall not affect dimensions and functional clearances. If the proposed substitution does affect dimensions and/or functional clearances, Contractor shall adjust the Work as required and necessary to accommodate the proposed substitution at no additional cost to the Contract. • Payment shall be made by the Contractor, via a deduct/credit Change Order, for changes to the building design, including A/E fees for the design and detailing, caused by the proposed substitution. • Coordination, installation, and changes to the Work as necessary for the accepted proposed substitution shall be complete in all respects.

Contractor Information	
Submitted by	
Signed By	
Date	
Email address of Signee above	
Company Name	
Address	
Phone	

Architect / Engineer Review and Action	
Acceptance of this substitution request is an acceptance of only the manufacturer and product/item for general conformance with the design concept reflected in the Contract Documents. The A/E has made no attempt to verify specific performance data, or to check the details of the proposed substitution as to special features, capacities, physical dimensions, or code and/or regulatory compliance, all of which remain the responsibility of the Contractor.	
☐ Proposed Substitution is found to be acceptable for inclusion in Change Order, if approved by Owner – Provide submittals in accordance with Contract Document requirements.	
☐ Proposed Substitution is found to be acceptable as noted for inclusion in Change Order, if approved by Owner - Provide submittals in accordance with Contract Document requirements.	
☐ Proposed Substitution is rejected – Provide specified product/item.	
☐ Proposed Substitution submittal/form not in accordance with Contract Documents (not timely, incomplete)	
Comments / Remarks	
Reviewed by	
Signed By	
Date	

END OF SUBSTITUTION REQUEST FORM

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: General product requirements.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Electronic File Distribution: Upon request, Contractor may be provided electronic files for use in coordination of the Work and preparation of submittals. Contractor shall submit a signed Request Form for Electronic Files, provided by the Architect.

1. Electronic files do not contain all of the information of the Bid Documents or Contract Documents for construction of the Project, and the Architect shall not be responsible for differences between electronic files, Bid Documents, and Contract Documents.

1.03 SUBMITTALS

A. General Contractor Personnel: Within 15 days after award of Contract, provide a summary of General Contractor's on site personnel. Identify each individual, beginning with project superintendent. List project responsibilities, cell phone number, and email address.

B. Subcontractors: Within 15 days after award of Contract, provide a summary of all companies and individuals engaged as subcontractors for any part of the Project. Include a contact name, company address, phone number, and email address, and identify what part of the Work shall be completed by each subcontractor.

C. Coordination Drawings: Submit completed Coordination Drawings for Architect's information.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.

1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
2. It is Contractor's responsibility to submit documents in allowable format.
3. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
4. Paper document transmittals will not be reviewed unless previously approved; emailed electronic documents will not be reviewed.

5. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: Coordinate method for exchanging files no later than the Preconstruction Meeting. The Architect's Procore service and procedures can be used at no charge. If the Contractor chooses to use a different platform and methodology:
   1. The Architect may reject the methodology or platform proposed and:
      a. use the Architect's Procore service, or
      b. the project team will revert to traditional hard-copy exchange;
   2. or the Contractor shall bear the cost of software, licensing, training, etc., for the project team to participate.

C. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive/record copies of files for Owner. If the Project Team uses an alternate platform preferred by the Contractor, the Contractor shall be responsible for distributing archive/record copies of files to Owner and Architect.

3.02 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.
   4. Owner's Commissioning Agent.
   5. Major subcontractors, consultants, and others as necessary and appropriate.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.
   8. Site mobilization and utilization.
   9. Other project-specific items on pre-distributed agenda.

D. Architect shall record minutes and distribute digital copies to Owner, Contractor, and other attendees. Contractor shall be responsible for distribution to subcontractors and other personnel affected by decisions made.

3.03 INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN DEVELOPMENT SESSION

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Owner's Commissioning Agent.
   3. Architect.
   4. Mechanical engineer.

5. Contractor.
6. HVAC subcontractor.
7. Other major subcontractors, consultants, and others as necessary and appropriate.

C. Agenda:
1. Protection of Materials: Discussion of how and where materials that could impact IAQ will be stored, including but not limited to, the following:
a. Insulation.
b. Gypsum board.
c. Flooring materials.
d. Ceiling panels.
e. Furnishings.
f. Odorous chemicals.
2. Protection of HVAC: Discussion of how HVAC equipment will be stored installed, and operated during construction.
3. Pathway Interruption: Discussion of how airflow between construction zones will be limited to prevent the spreading of pollutants from one part of the building to another.
4. Housekeeping: Discussion of how the building will be kept clean and dry.
5. Materials Installation Scheduling: Discussion of what wet (odor emitting) materials will be used on the project, in order to schedule their installation before fuzzy (odor absorbing) materials.

3.04 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section. Do not allow installation of affected work to proceed until preinstallation meeting can be held.
1. Include all preinstallation meetings on the Project Schedule.

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

C. Notify Architect and Owner 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 copies to Architect, Owner, participants, and those affected by decisions made.

3.05 PROGRESS MEETINGS

A. Architect will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

B. Attendance Required:
1. Owner.
2. Architect.
3. Contractor's superintendent.
4. Other subcontractors or consultants as required for the specific parts of the Work to be discussed.

C. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.

3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Maintenance of quality and work standards.
11. Effect of proposed changes on progress schedule and coordination.
12. Other business relating to the work.

D. Architect shall record minutes and distribute copies to the Owner, Contractor, and other consultants, Owner's representatives, or other third party attendees. The Contractor shall be responsible for distributing to any affected subcontractors and other personnel.

3.06 CLOSEOUT MEETING

A. Schedule and administer closeout meeting no later than 30 days before the scheduled Date of Substantial Completion.

B. Make arrangements for the meeting, prepare agenda with copies for participants, and preside at the meeting.

C. Attendance Required:
1. Owner.
2. Architect.
3. Contractor's superintendent.
4. Major subcontractors.
5. Other subcontractors or consultants as required.

D. Agenda:
1. Review closeout requirements and procedures in Division 1 Section "Execution and Closeout Requirements."
2. Review startup, testing, and adjusting of all systems, including testing/adjusting/balancing and Commissioning,
3. Coordination of inspections by local authorities having jurisdiction and third party Special Inspectors as required to obtain Certificate of Occupancy.
4. Coordination of Owner's occupancy and changeover of utilities, insurance, and building keying/lock system.
5. Procedures for Contractor's Correction Punch List, Architect's Substantial Completion inspection, and Final Correction Punch List.
6. Delivery, turnover, and storage of maintenance materials, attic stock, special tools, and other non-installed materials.
7. Coordination of closeout documentation, including demonstration and training materials and videos, as built/record documents, operation and maintenance binders, and warranty binders.
8. Removal of temporary facilities, construction equipment, and tools.
9. Final cleaning, touchup, restoration, and preventive maintenance.
10. Coordination of final Applications for Payment.

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

3.07 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

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

3.08 COORDINATION DRAWINGS AND COORDINATION CONFERENCE

A. Coordination Drawings: The Contractor shall prepare coordination drawings of all spaces where utilities, systems, and other components converge or intersect and efficient installation is required to accommodate all components.
   1. Prepare coordination drawings of the following spaces, at minimum. Supplement with additional spaces as required by project-specific conditions.
      a. Above ceilings.
      b. Vertical chases, shafts, and wall cavities.
      c. Mechanical and electrical rooms, fire pump room, and other major utility spaces.
   2. Provide accurate overall dimensions of components (for example, outside diameters of pipe and conduit, or overall ductwork dimensions including insulation and enclosure thickness).
   3. Include accessory components of systems that could cause potential conflicts, such as bracing, slotted channel framing, hangers, and other supports, valve handles, flanges, fittings, cable/wire management trays, and other similar components.
   4. Include sequence of installation of all components, materials, and systems.
   5. Include means of access to each component, material, or system, for maintenance and repairs.
   6. Provide additional coordination drawings as required by individual specification sections.
   7. Prepare Coordination Drawings using project-specific information. Do not use photocopies or reproductions of Contract Documents, and do not use standard details or data from manufacturers, suppliers, or other outside parties.
   8. Drawing Files: The Contractor may develop coordination drawings using 2D CAD software or with 3D BIM software with clash-detection functionality.

a. The Architect will furnish original 3D BIM model or 2D DWG files for Contractor's use upon receipt of Architect's "Request Form for Electronic Files". A copy of this form shall be provided to the Contractor upon request.
   1) The Architect makes no guarantee to the accuracy of components in electronic files. The Contractor shall coordinate electronic data with the Contract Documents in order to provide final Coordination Drawings.
   2) If using 2D files, the Contractor shall prepare drawings in multiple views (for example, RCP and section) to fully represent 3D space, for example plenum heights, wall assembly thicknesses, etc.

9. Submittal: Submit Coordination Drawings as a "Submittal for Information." Architect will not approve Coordination Drawings, but will keep on file for use in subsequent coordination and conflict resolution.

B. Coordination Conference: Schedule and conduct a Coordination Conference prior to beginning construction or rough-in of affected work. Require attendance by all affected trades and installers.
   1. Identify the Coordination Conference as a "milestone" date on the Construction Progress Schedule.
   2. Advise the Architect of all potential conflicts identified in the Coordination Drawings and at the Coordination Conference.
   3. Do not proceed with construction or installation of components, materials, or systems until potential conflicts have been resolved and affected parties have agreed to a remedy.
   4. Remedies to address conflicts not identified in the Coordination Drawings, at the Coordination Conference, or otherwise addressed prior to construction or installation of affected components, materials, and systems, or discovery of a non-workable situation not identified or addressed, will not be considered as a basis for delay, time extension, or additional cost to the Contract.

3.09 REQUESTS FOR INFORMATION (RFI)

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

B. 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 Owner.
   3. Prepare using software provided by the Electronic Document Submittal Service.
   4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is 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 - 016000 - 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.
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.
    a. The Owner 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.

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

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

F. 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.

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

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 Owner.

1. When the Architect provides a response to an RFI, that RFI shall be closed. If there is additional information required, or a question about the response itself, then another RFI with a new number shall be generated by the Contractor. At no time shall an RFI be "re-opened" or remain open after the Architect has formally responded.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.10 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. 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.
      b. Account for a reasonable duration of time to allow for final color selections, approvals, and preparation of final finish schedules (one finish schedule for interior color selections, and one for exterior color selections). This period shall begin upon receipt of all submittals requiring color selection.

3.11 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Design data.
   3. Shop drawings.
   4. Samples for selection.
   5. 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. Color Selection: In individual specification sections, specific items are identified which require color/finish selections to be made by the Architect from color chart or sample submittals. The Submittal Schedule, prepared according to “Submittal Schedule” paragraph above, shall identify these required color/finish submittals.
   1. Submittals requiring color selection must be submitted by Contractor and approved by Architect for conformance with Contract Documents prior to the start of the color selection process. When the submittals have been approved for conformance with Contract

Documents, the process for color selection, presentation of color concepts, Owner approval, and Color Schedule preparation will begin.

2. Interior Color Selections: The Architect will make coordinated selections of colors/finishes for the building interior, present the resulting color concepts to the Owner for approval, and prepare the actual Interior Color Schedule for the Work.
3. Exterior Color Selections: The Architect will make coordinated selections of colors/finishes for the building exterior and prepare Exterior Color Schedule.

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

3.12 SUBMITTALS FOR INFORMATION

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

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

3.13 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

3.14 NUMBER OF COPIES OF SUBMITTALS

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

B. Selection Samples: Submit one set of manufacturer's charts indicating full range of available colors, textures, patterns, and other aesthetic qualities.

C. Verification Samples: Submit three sets of physical samples. Two sets will be retained by Architect, the third will be returned to the Contractor. Maintain approved sample at the Project site for use in comparing to installed Work.
1. Where a full-size assembly of multiple components is required as a sample (for example, railing section or full-size cabinet), only one sample is required for those items.

3.15 SUBMITTAL PROCEDURES

A. General Requirements:
1. Use a single transmittal for all submittals required by each individual specification section, unless otherwise indicated.

a. Verification samples and large shop drawing submittals may be submitted under separate cover when approved by Architect.

2. Transmit using AIA G810 or other approved form.
3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
   a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
6. 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.
   a. Upload submittals in electronic form to Electronic Document Submittal Service website.
7. Schedule submittals to expedite the Project, and coordinate submission of related items.
   a. Allow sufficient time for administrative processing, Architect's initial review, and potential resubmittals.
      1) Large submittals may require longer review durations. Large or multi-part submittals (such as structural steel or aluminum storefront and curtainwall) may be submitted by building area, building level, or otherwise subdivided "packages" with the approval of the Architect. Subdivided "packages" will be reviewed one at a time in the order received. If large submittals are submitted in their entirety as a single package, the Architect may elect to review and return portions of the submittal individually, and will coordinate the schedule for return of these partial reviews with the Contractor for sequencing in the Work.
   b. Allow additional time for submittals requiring sequential reviews involving Architect's consultants, Owner, or another affected party.
   c. Allow additional time for submittals requiring sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval.
   d. No extensions to the project schedule shall be granted due to delays that can be attributed to submittal processing or failure to allow for sequential reviews or resubmittals.
8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
9. When revised for resubmission, identify all changes made since previous submission.
10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
11. Incomplete submittals may not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
12. Submittals not requested will be recognized, and will be returned "Not Reviewed".

B. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Submit concurrently with related shop drawing submittal.
   4. 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.
3. Selection Samples: Provide color charts that accurately relay color, pattern, and texture information. Photographs or photocopies of color charts are unacceptable and subject to rejection.
4. Verification Samples: Provide physical samples of each color selected by Architect from Selection Samples. Verification samples shall be manufactured and prepared identically to the material that shall be used in the installed Work. Label each sample clearly with manufacturer, product name, and color, texture, and/or pattern name as applicable. Photographs of physical samples are unacceptable and subject to rejection.

3.16 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, but will take no other action.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Approved as Noted":
1) Where review notations indicate revisions are necessary, submit corrected item, with review notations acknowledged and incorporated.
2. Not Authorizing fabrication, delivery, and installation:
a. "Revise and Resubmit":
1) Resubmit revised item, with review notations acknowledged and incorporated.
b. "Rejected/Resubmit":
1) New submittal required, with item complying with requirements of Contract Documents.
c. "Color Selection Required":
1) Color selections for the entire project, or portion thereof, will be provided after receipt of all color charts and samples required for the Project.
d. "Not Submitted":
1) Additional submittal items are required that were not provided in the original submittal.

E. Architect's actions on items submitted for information:
1. Items for which no action was taken:

a. "Not Reviewed": To notify the Contractor that the submittal has been received for record only.

END OF SECTION 013000

SECTION 013216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit in PDF format.

1.02 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.03 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

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

3.02 CONTENT

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

B. Identify work of separate phases and other logically grouped activities.

C. Identify all major milestone dates, including, but not limited to, Notice to Proceed and Substantial and Final Completion dates.

D. Identify duration of each activity, in maximum 15 day intervals.

E. Incorporate work restrictions indicated in Section 011000 - Summary, if any.

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

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

H. Indicate procurement duration and delivery dates for long-lead time items.

I. Coordinate submittal approval process with procurement and delivery requirements. Submittals requiring resubmission or revision for approval will not be allowed as a basis for schedule impacts.

J. Indicate delivery dates for owner-furnished products and products identified under Allowances.

K. Indicate the time period for color selection activity and approval by Owner and Architect, as required per Section 013000 - Administrative Requirements.

L. Indicate date of changeover from temporary to permanent utilities.

M. Indicate time periods for Commissioning activities, equipment startup, and testing and balancing.

N. Provide a reasonable time period prior to the date of Substantial Completion for administrative activities and procedures.

O. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

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

B. Identify critical path activities.

C. Identify the first work day of each week.

3.04 NETWORK ANALYSIS (CPM)

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
   11. Percentage of activity completed.
   12. Responsibility.

D. Analysis Program: Capable of accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.

3. In order of latest allowable finish dates.
4. Listing of activities on the critical path.

3.05 REVIEW AND EVALUATION OF SCHEDULE

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

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

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

3.06 UPDATING SCHEDULE

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

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

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

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

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

F. Schedule revisions shall not modify any Contract Dates or the Contract Sum, unless specifically approved and documented via Change Order.

G. Submit reports required to support recommended changes.

H. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

I. Recovery Schedule: If the Contractor is 14 or more days behind schedule, in the opinion of the Owner, the Contractor shall prepare a Recovery Schedule, incorporating a reasonable, mutually agreed upon length of time to return the Work to the approved Schedule. The Recovery Schedule shall be prepared to the same level of detail as the original construction progress schedule. Submit the recovery schedule for Owner review; do not proceed until the Owner has approved.
   1. At the end of the recovery period, Owner shall reevaluate construction progress and determine if the Recovery Schedule has been successfully completed. If completed, Owner shall direct the Contractor to proceed with the latest approved Construction Schedule.
      a. If the Contractor is still behind schedule at the end of the recovery period, the Owner shall direct the Contractor to provide additional schedule revisions to complete the recovery, or may at its option pursue other means of resolution as provided for by the Contract Documents.
   2. Need for and preparation of a Recovery Plan shall not be the basis of additional cost to the Owner or extension of Project Schedule, unless the Contractor can demonstrate that the reason for being behind schedule is no fault of their own.

3.07 DISTRIBUTION OF SCHEDULE

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

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

END OF SECTION 013216

SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

B. Contractor's Professional Design Services/Delegated Design: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
   1. Design Services Types Required:
      a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.
      b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.02 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
   1. Temporary sheeting, shoring, or supports.
   2. Temporary scaffolding.
   3. Temporary bracing.
   4. Temporary falsework for support of spanning or arched structures.
   5. Temporary foundation underpinning.
   6. Temporary stairs or steps required for construction access only.
   7. Temporary hoist(s) and rigging.
   8. Investigation of soil conditions and design of temporary foundations to support construction equipment.
   9. Additional temporary controls as required.

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.
   1. Submit a Request for Information to Architect if the criteria indicated are not sufficient to perform required design services.

C. Scope of Design Services/Delegated Design: As required by individual specification sections.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
   1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
      a. Full name.
      b. Professional licensure information.
      c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

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

D. Test Reports: After each test/inspection, require testing agency to promptly distribute digital copy of report to Architect, Owner, Contractor, and others as required.
   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.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor 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.

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

G. Manufacturer's Field Reports:
   1. Submit report promptly 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.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Qualification Statement: Provide documentation showing testing laboratory is accredited under OSHA's Nationally Recognized Testing Laboratory (NRTL) program or through the National Institute of Standards and Technology's (NIST's) National Voluntary Laboratory Accreditation Program (NVLAP).

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Contractor's Quality Control (CQC) Plan:
   1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
      a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
         1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
      b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
         1) Management and control of documents and records relating to quality.
         2) Communications.
         3) Coordination procedures.
         4) Resource management.
         5) Process control.
         6) Inspection and testing procedures and scheduling, including inspections by authorities having jurisdiction and special inspections.
         7) Control of noncomplying work.
         8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
         9) Control of testing and measuring equipment.
         10) Project materials certification.
         11) Managerial continuity and flexibility.
      c. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

1.06 REFERENCES AND STANDARDS

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

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

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

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

E. Should specified reference standards conflict with Contract Documents, comply with the higher quality or quantity, and provide documentation of the conflict to the Architect.

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

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform Special Inspections and other specified testing indicated in individual specification sections.

B. Where indicated in individual specification sections, Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

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

D. Contractor Employed Agency: Testing agency shall comply with requirements of ASTM E 329, and shall be certified through OSHA's Nationally Recognized Testing Laboratory (NRTL) program or through the National Institute of Standards and Technology's (NIST's) National Voluntary Laboratory Accreditation Program (NVLAP).

1. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

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 MOCK-UPS

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

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

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

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

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

F. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

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

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

3.03 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.

3.04 TESTING AND INSPECTION

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

B. Testing Agency Duties for Contractor-Employed Testing and Inspection Agencies:
   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.

C. 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.

D. 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 storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
7. Coordinate repairs where testing and inspection has damaged the Work.

E. Re-testing and/or re-inspections required because of non-compliance with specified requirements shall be performed by the same agency. Do not proceed with construction activities that would conceal or cover work needing re-testing or re-inspection.

F. Re-testing and/or re-inspections required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 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, and field quality control requirements as applicable, and to initiate instructions when necessary.

B. Provide a written report of observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions or Contract Documents. Obtain Owner's approval prior to proceeding with any modifications.

3.06 DEFECT ASSESSMENT

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

B. Contractor may request to restore defective Work or portions of the Work to comply with specified requirements in lieu of replacement. Obtain Owner's approval prior to proceeding with restoration.

C. If, in the opinion of Owner, it is not practical to restore or remove and replace the work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION 014000

SECTION 014200
DEFINITIONS AND REFERENCE STANDARDS

PART 1 GENERAL

1.01 SUMMARY

A. The definitions include in this section supplement, but do not replace, the definitions contained in the General Conditions. In the event of duplication, the General Conditions shall govern.

B. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

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

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

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

D. Provide: To furnish and install.

E. Supply: Same as Furnish.

F. Installer: A Contractor or other entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that specified requirements apply exclusively to tradespeople of the corresponding generic name.

G. Experienced: When used with the term "Installer," this term means having successfully completed previous work similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with the requirements of local authorities having jurisdiction.

H. Replace: Provide an acceptable like product or material in place of a missing or unacceptable (rejected) product or material. To "replace" an unacceptable product or material includes its removal and disposal.

I. Punch List: A written list of unfinished Work and defective Work resulting from inspection and testing to determine whether Substantial Completion has been accomplished. The unfinished Work and defective Work must be finished and corrected to obtain Substantial or Final Completion, in accordance with the General Conditions.

J. Written or Printed: When used in conjunction with manufacturer's product data or installation requirements, either of these terms may be used to require compliance with manufacturer's current printed and published information.

1.03 REFERENCE STANDARDS

A. For products or 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 or local authorities having jurisdiction.

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

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 014200

SECTION 014520 - TESTING, ADJUSTING, AND BALANCING (TAB)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including sub-mains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. TAB Agent: The entity responsible for performing and reporting the TAB procedures.

M. AABC: Associated Air Balance Council.

N. AMCA: Air Movement and Control Association.

O. CTI: Cooling Tower Institute.

P. NEBB: National Environmental Balancing Bureau.

Q. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

R. TAB: Testing, Adjusting, and Balancing

1.3 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days of the Contractor's Notice to Proceed, submit evidence that the TAB Agent and this Project's TAB team members meet the qualifications indicated in the "Quality Assurance" Article below.

B. Warranty: Submit warranties indicated below.

C. Special Guarantee: Submit Special guarantee indicated below

D. Contract Documents Examination Report: Within 60 days of the Contractor's Notice to Proceed, submit the Contract Documents review report as indicated in Part 3 below.

E. Strategies and Procedures Plan: Within 90 days of the Contractor's Notice to Proceed, submit the TAB strategies and step-by-step procedures as indicated in Part 3 below. Include a complete set of report forms intended for use on this Project.

F. Testing Adjusting and Balancing Conference Notification: Within 120 days of the Contractor's Notice to Proceed, submit the testing adjusting and balancing conference notification. The notification shall include the date, time and location of the conference as well as a list of attendees.

G. TAB Conference Minutes: Within 180 days of the Contractor's Notice to Proceed, submit the TAB conference minutes. Minutes shall include a list of attendees and a record of the discussions and decisions made during the conference.

H. System Readiness Reports: 60 days prior to substantial completion the contractor performing work under section "Building Automation System" (BAS) shall complete pre-commissioning checklists. The contractor performing work under this section shall, as part of the system readiness report, witness pre-commissioning activities and shall initial each element on the pre-commissioning checklist. The system readiness report shall be completed and submitted as specified. Do not include the checklists as they will be submitted under section "BAS".

I. Certified TAB Reports: Within 60 days of substantial completion submit the testing and balancing reports prepared, as indicated in this Section, on approved forms certified by the TAB Agent.

1. Balancing report.

1.4 QUALITY ASSURANCE

A. Agent Qualifications: Agent and agent's representatives shall be certified by either AABC or NEBB. The testing and balancing agent shall be one of the following:

1. C&W Tesco, Inc.
   430 Southlake Boulevard, Suite B-12
   Richmond, VA 23236
   804.379.9345

2. Complete Commissioning, Inc.
   6304 Aaron Lane
   Clinton, MD 20735
   301.877.2260

3. Mechanical Systems Testing and Balancing, Inc. (MSTB)
   7314 Impala Drive
   Richmond, Virginia 23228
   804.264.0454

4. Testing Specialties, Inc.
   PO Box 2788
   Chesapeake, VA 23327
   757.436.2345

B. Testing and Balancing Agents not listed shall be permitted to bid. The following information shall be submitted as part of the Quality Assurance Submittal:

1. Provide evidence of satisfactory completion of at least two projects of similar size and scope. Submit the following for each project:
   a. Completed testing and balancing reports for each project.
   b. If not included in the testing and balancing report, provide equipment startup checklists for each project.
   c. Owner contact for each project.
   d. Design engineer contact for each project.
   e. Architect contact for each project.

2. The architect shall determine whether the agent is qualified and the decision shall be final. Re-submittals on behalf of the same company shall not be considered.

C. TAB Conference: Meet with the Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Set meeting and submit TAB Conference Notification.

1. Minimum Agenda:
   a. Submittal distribution requirements.
   b. Contract documents examination report.
   c. TAB plan.
   d. Work schedule and project site access requirements.
   e. Coordination and cooperation of trades and subcontractors.

f. Coordination of documentation and communication flow.

D. TAB Reports: Use standard forms from AABC's "National Standards for TAB" or NEBB's "Procedural Standards for TAB of Environmental Systems."

E. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for TAB of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.5 PROJECT CONDITIONS

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire TAB period. Minimize conflicts with the Owner's operations.

1.6 COORDINATION

A. Coordinate the efforts of work performed under other sections for operation of systems and equipment to support and assist TAB activities.

B. Notice: Provide 7 days' advance notice to the contractor and Moseley Architects for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air, water, potable water, and non potable water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. General Warranty: The national project performance guarantee indicated in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Guarantee: Provide a guarantee on NEBB or AABC forms stating that NEBB or AABC will assist in completing the requirements of the Contract Documents if the TAB Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified Agent has tested and balanced systems according to the Contract Documents.

2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are hereby required by the Contract Documents.
2. Verify that quantities and locations of devices proposed by the contractor and indicated on the Contract Documents are accessible and appropriate for effective balancing and efficient system and equipment operation.
3. Verify flow rates specified and compare to central equipment capacities.
4. Identify discontinuities and omissions in the Contract Documents.
5. Provide a detailed Testing and Balancing plan within six weeks of the Notice to Proceed.
6. Provide a TAB technician to work at the direction of the CxA for up to a consecutive six work day period on site to assist in testing.
7. Record configuration, set up, parameters, etc, that change during the testing period.
8. Provide representative(s) for up to 16 hours of off-season testing each. Any and all time is required to be spent at the job site.
9. Respond to Warranty issues. Record configuration, set up, parameters, etc, that change during the warranty period.

B. Examine BAS submittal data prior to submission and provide comments to contractor, and Moseley Architects.

C. Examine submittal data of HVAC systems and equipment prior to submission and provide comments to contractor, and Moseley Architects.

D. Examine project record documents and provide comments to contractor, and Moseley Architects.

E. Examine Architect's design data, including HVAC system descriptions, statements of design, assumptions for environmental conditions, control drawings, and statements concerning systems and equipment.

F. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--

Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

G. Examine system and equipment installations to verify that they are complete and that TAB, and cleaning indicated has been performed.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment is ready for operation, including functioning controls.

K. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine strainers for clean screens and proper perforations.

M. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

O. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.

P. Examine equipment for installation and for properly operating safety interlocks and controls.

Q. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices operate by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in mixing boxes and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.

9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to design values.

R. Report deficiencies discovered before and during performance of TAB procedures.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards or NEBB's "Procedural Standards for TAB of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.

3. Motor rpm.
4. Efficiency rating if high-efficiency motor.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass to prove proper operation. Record observations, including controller manufacturer, model number, serial number, and nameplate data.

3.5 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with air, water, and potable water-flow measurements. Note the speed of response to input changes.

G. Confirm interaction of electrically operated switch transducers.

H. Confirm interaction of interlock and lockout systems.

I. Record voltages of power supply and controller output. Determine if the system operates on a grounded or non-grounded power supply.

J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.6 TOLERANCES

A. Set system airflow, water, and potable water-flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: 0 to plus 10 percent.
2. Air Outlets: minus 10 percent to plus 10 percent.
3. Return Inlets: minus 10 percent to plus 10 percent.
4. Exhaust Inlets: 0 to plus 10 percent.

5. Heating-Water Flow Rate: minus 5 percent to plus 5 percent.
6. Cooling-Water Flow Rate: minus 5 percent to plus 5 percent.
7. Potable water: minus 5 percent to plus 5 percent.
8. Unless indicated otherwise: minus 10 percent to plus 10 percent.

3.7 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: When 50% of the construction contract period has elapsed, the contractor performing work under this section shall visit the site twice per month thereafter. After each site visit for each system being tested and balanced, prepare a report to describe completed work, work in progress, and work at variance with the contract documents. Include a list of deficiencies and problems found in each system. Prepare a separate report for each system and each building floor for systems serving multiple floors. Submit the report to the contractor and architect. The contractor shall be responsible for ensuring that deficiencies are corrected. Deficiencies shall remain on the list permanently, shall be issued with each report, and shall be checked off only when they are corrected.

3.8 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to the certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB Agent.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Contractor's name and address.
7. Report date.
8. Signature of TAB Agent who certifies the report.
9. Table of contents.
10. Operating sequences that vary from the Contract Documents.
11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type, and size.
13. Notes to explain why certain final data in the body of reports varies from design values.
14. Test conditions for fans and pump performance forms, including:
    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Fan drive settings, including:
        1) Percentage of maximum pitch or diameter.
        2) Maximum RPM.
        3) Minimum RPM on VAV systems.
    e. Settings for supply-air static-pressure controllers on VAV systems.
    f. System operating parameters/conditions that affect performance.

E. System Diagrams: Include schematic layouts of air, and water distribution systems. Provide single-line diagrams including the following:

1. Quantities of outside, supply, return, exhaust, and water flow rates.
2. Duct outlet, and inlet sizes.
3. Pipe sizes and locations.
4. Indicated Terminal unit(s): Information & location(s).
5. Indicated Balancing station(s): Information & location(s).
6. Indicated Meter(s): Information & location(s).

F. Test Reports:

1. All equipment test reports.
2. Duct Traverse Reports.
3. Terminal-Device Reports.
4. Coil Reports.

5. Instrument Calibration Reports.

3.9 ADDITIONAL TESTS

A. When requested, provide up to six continuous and consecutive work days, by the technician that provided services under this section, directly knowledgeable of all systems and procedures specific to the project, to support commissioning for TAB verification.

B. TAB verification site visit will be conducted after the TAB final report has been submitted and approved by the engineer of record.

C. Within 90 days of completing work performed under this section, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

D. Seasonal Periods:

1. Winter: Re-test heating equipment, including central equipment and terminal devices, when the outside air temperature is below 30 degrees F.

2. Summer: Re-test cooling equipment, including central equipment and terminal devices, when the outside air temperature is above 90 degrees F.

END OF SECTION 014520

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 DEWATERING

A. Provide temporary means and methods for dewatering all temporary facilities and controls, in compliance with local authority having jurisdiction.

B. Maintain temporary facilities in operable condition.

1.02 TEMPORARY UTILITIES

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

B. New permanent facilities may be used, with prior Owner authorization.
   1. Use of permanent facilities shall not impact specified warranties. Equipment shall be maintained during temporary usage.

C. Temporary Lighting: Provide temporary lighting of type and producing lighting levels necessary for proper installation of the Work.

D. Temporary Heating, Cooling, and Ventilation: Provide temporary measures and equipment as required for curing, drying, and humidity control. Comply with manufacturer's installation instructions for specific product requirements.
   1. Provide measures and equipment to meet warranty requirements of interior woodwork specified in Division 6 and/or Division 12 sections.
   2. Use of Permanent HVAC Facilities and Equipment: Use of HVAC equipment shall be subject to Owner approval.
      a. Protect new and existing HVAC equipment from intrusion of dust, silica, dirt and debris during construction operations.
      b. Cover all openings in new and existing inactive ductwork during construction operation with minimum 6 mil polyethylene sheet.
      c. Where use of existing HVAC equipment is approved by Owner, provide temporary filters with a minimum MERV of 8. Change the filters every two weeks while construction is ongoing. Provide new filters at Substantial Completion; do not change out temporary filter until approved by Architect.
      d. Do not perform testing and balancing of HVAC equipment until dust, silica, dirt and debris producing activities are complete.

E. Temporary Water: For the duration of construction or until permanent water service is available at the site, the Contractor shall provide a temporary water source, as part of the Contract Price.

F. Temporary Electric Service: Until electric utility provides permanent service at the site, the Contractor shall provide temporary electrical power, as part of the Contract Price.

G. Temporary Sewer and Drainage: Comply with requirements of local authority having jurisdiction for connection of temporary sewer to public system.

1.03 TELECOMMUNICATIONS SERVICES

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

B. Telecommunications services shall include:
   1. Telephone Service: Contractor shall ensure that all of its forces, including on-site managers/supervisors of each Subcontractor, have mobile devices and adequate voice

and data coverage for on-site operations.

2. Internet Connections: Minimum of one; DSL modem or faster.
3. Video Conferencing and Video Site Visit/Walkthrough Infrastructure: Maintain personal computer/laptop with large format display screen and video conferencing software in the common-use field office.
    a. Maintain equipment in common-use field office for site visits and walkthroughs, including a portable, high quality digital video camera, audio headset with microphone for walkthrough commentary/narration, and accessories including connection cables and battery packs.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
    1. Provide temporary unisex toilet units and all required disposable supplies.
    2. Provide handwash stations and hand sanitizer at each toilet unit.
    3. Provide regular servicing of portable facilities by professional servicing company; including draining, cleaning, and disinfecting.

B. New permanent facilities may not be used during construction operations.

C. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

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

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

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

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

1.06 FENCING

A. Barrier Mesh Fence: Provide minimum 6-foot height open-mesh polypropylene barrier fabric mounted on lumber or galvanized steel posts to isolate and define construction area and prevent accidental public access.

B. Construction: Commercial grade chain link fence.
    1. Contractor may provide either fixed or portable fencing to suit conditions. For portable fencing, provide concrete or galvanized steel bases for supporting posts. Bases for portable fencing shall not obstruct sidewalks or other pathways used by pedestrians.

C. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

D. Unless otherwise indicated, provide barrier mesh fencing to enclose the approximate extent of the entire construction site. Chain link fencing shall be used to enclose Contractor's field office and laydown/storage areas, areas of the site actively in construction, and as deemed necessary by Contractor.

1.07 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent

entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 INTERIOR ENCLOSURES

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

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

1.09 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
   1. Contractor shall repair damage to existing facilities caused by Construction operations.

B. Coordinate with Owner's security program.

C. Environmental Protection: Comply with EPA, OSHA and other regulatory requirements to prevent contamination of site, air, and public sewer/runoff.
   1. Provide additional work restrictions and protective measures as indicated on Civil/Site Drawings and as specified in Section 011000 - Summary.

1.10 VEHICULAR ACCESS AND PARKING

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

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

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

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

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

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

G. Provide watering trucks, mulch, chemical stabilizers, or other control measures, complying with environmental protection requirements, to prevent airborne dust and silica from becoming a nuisance or health issue to Contractor personnel, neighboring properties, and the public.

1.11 WASTE REMOVAL

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

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

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

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

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

1.12 PROJECT IDENTIFICATION

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

1. Obtain and pay for any permits required for temporary signage by local authority having jurisdiction.

B. Erect on site at location(s) established by Architect.

C. Provide temporary directional signage as directed to facilitate site access for visitors and other construction personnel.

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

1.13 FIELD OFFICES

A. Field Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture and drawing display table.
   1. Provide space for Project meetings, with table and chairs to accommodate 10 persons.
   2. Provide drinking water/water cooler and a private bathroom.
   3. Maintain the following materials in the field office, available to Architect and Owner's representative at all times:
      a. A complete, up-to-date set of all Contract Documents, including FCs, RFIs, PCOs, and COs.
      b. A complete, up-to-date set of all reviewed final shop drawings.
      c. The most recent, up-to-date version of Contractor's Progress Schedule.

B. Locate offices a minimum distance of 30 feet from other structures.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

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

B. Remove temporary underground installations.

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

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

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

PART 2 PRODUCTS

2.01 MATERIALS

A. Rough Carpentry: 2x lumber, in length and depth required for floor to ceiling partitions. Partitions shall not be fastened to existing ceilings or flooring to remain. Provide additional bracing and concealed attachments to building structure.

B. Gypsum Board: 1/2-inch gypsum wallboard; ASTM C 1396.

C. Insulation: Mineral-wool fiber blankets; with maximum flame-spread and smoke-developed ratings of 25 and 50 when tested per ASTM E 84.

D. Polyethylene Sheet: Minimum 10 mil reinforced sheeting; achieving a passing rating when tested per NFPA 701, and a maximum flame-spread rating of 15 when tested per ASTM E 84.

E. Walk-Off Mats: Dust-, dirt- and silica-control walk-off mats at each entrance into the enclosed construction area and each entrance through temporary partitions.

F. Hardware: Provide temporary hinges, latch, and lock at doors in temporary partitions. Where doors in temporary partitions are also indicated to serve as egress, provide ADA-compliant exit device and closer.

2.02 EQUIPMENT

A. Fire Extinguishers: Provide portable UL rated extinguishers. Provide extinguisher types rated for potential classes of fire expected for construction work indicated.

PART 3 EXECUTION

3.01 ELEVATOR AND STAIR USAGE

A. Use of new or existing elevator(s) is not permitted.

B. Use of existing stairs is permitted. Cover existing finishes and maintain stairs without damage. Clean and restore stairs to Owner's approval at Substantial Completion.

C. Use of new stairs is permitted. To prevent wear on finishes, do not install finishes on stairs until construction foot traffic can be minimized. Clean and prepare stair substrate thoroughly prior to installation of finishes. Cover finishes after installation, and clean and restore to Owner's approval at Substantial Completion.

1. Provide temporary stairs until new stairs are available.

3.02 PEST CONTROL

A. Provide pest-control services at regular intervals, performed in compliance with regulations of state regulations, and by a pest-control firm licensed in the state where the project is located. Any chemicals and pesticides used shall be approved by EPA and local authority having jurisdiction. Contractor's pest control plan shall ensure the facility is free of termites, roaches, rodents, and other pests at time of Substantial Completion.

1. Coordinate with Owner's Integrated Pest Management (IPM) plan where applicable.
2. Provide Owner with a minimum 72 hours pre-notification for pest-control treatments.

3.03 TEMPORARY FIRE PROTECTION

A. Comply with International Fire Code, Chapter 33 "Fire Safety During Construction and Demolition" for preventing damage to structures under construction.

1. Comply with NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations" for additional provisions and conditions that are not covered by Chapter 33 of the International Fire Code.

B. Provide a fire-prevention program, review with all personnel on site, and post fire-prevention information in clearly visible area. Coordinate fire-prevention program with local fire department.

C. Provide clearly labeled portable fire extinguishers.

D. Provide fire watch in compliance with OSHA requirements during and after use of all potential ignition sources, including but not limited to, welders, grinders, cutting torches, heating and electrical equipment, and lighting.

E. Do not allow smoking in areas under construction.

3.04 MOISTURE CONTROL

A. Prevent the absorption of moisture and humidity by:

1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
3. Provide sufficient ventilation for drying within reasonable time frame.

B. Prior to building dry-in, store porous materials in a separate enclosed storage building. Keep all surfaces clear of standing water, and cover or otherwise protect all materials from water

infiltration and damage. Do not enclose interior spaces until dry-in is complete and ventilation can remove excess moisture.

C. After building dry-in, provide temporary mechanical ventilation for humidity and moisture control until the building HVAC system is operational. Do not store or install material in the building until ambient temperature and humidity is within manufacturer's acceptable range. Do not install wet materials, and ensure that substrates are fully dry prior to installing other materials over them.

D. Provide continuous monitoring of installed materials. Remove gypsum board, wood products, and other mold-supporting products, if they become and remain wet for 48 hours. Remove and replace any materials showing visible signs of mold or mildew.

3.05 TEMPORARY FACILITY USAGE AND REMOVAL

A. Maintenance and Usage: Keep temporary facilities clean and in well-maintained condition for the duration of the Project. Prevent misuse of or damage to facilities by construction personnel. Make repairs to temporary facilities or replace facilities as required to keep them in good operating condition and in compliance with applicable OSHA, local permitting, and other applicable regulations.

B. Changeover: Coordinate changeover from temporary facilities to permanent facilities at Substantial Completion, unless an alternate arrangement for changeover has been agreed upon in writing by Owner.

1. Contractor shall be responsible for repair, restoration, and cleaning of permanent facilities that are used for construction purposes after changeover.

C. Removal: Unless otherwise indicated, temporary facilities and controls are the property of the Contractor, and shall be removed upon Architect's approval when Contractor can demonstrate that they are no longer needed.

1. Comply with construction waste management and recycling requirements for temporary facilities and materials that are not able to be reused.
2. After removal of temporary facilities and controls, complete all permanent construction that was not accessible due to the presence of temporary facilities.
3. Remove materials that have become soiled or contaminated due to construction vehicle traffic, parking, temporary field offices, oil or other chemical spillage, and other temporary usage, and replace with clean material. Complete grading, landscaping, paving, and other site improvements, and repair or restore all damage to existing or previously completed site improvements.

END OF SECTION 015000

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Comparable Product: An unnamed product that is similar in quality and performance to named product(s).

B. Basis-of-Design Product: A specific product selected by the Architect for use in the design process; based on certain performance characteristics, physical qualities or details, a specialized finish type, pattern, or color, or other indicated characteristics.

1.02 WARRANTIES

A. Product warranties shall be provided in addition to and run concurrently to Contractor's general warranty/guarantee.
   1. Unless otherwise indicated, all warranty terms shall start on the date of Substantial Completion.

B. Manufacturer's Warranty: A standard warranty issued by the product manufacturer, covering production and material defects.

C. Special Warranties: Warranties in addition to standard manufacturer's warranty, covering fabrication, installation, or specific performance items such as weathertightness

D. Warranty Form: Warranty shall be provided on either manufacturer's standard form or on specified form. When a sample warranty form is not included in the Project Manual, the warranty shall be on mutually agreed form.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

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

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

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

2.02 NEW PRODUCTS

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

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:
   1. Made using or containing CFC's or HCFC's.
   2. Containing lead, cadmium, or asbestos.

2.03 PRODUCT OPTIONS

A. Products Specified with a Single Named Product: Where required by Owner due to facility standards, provide the named product; no options or substitutions allowed.

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

C. 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.

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

E. Products Specified by Naming One or More Manufacturers with a Provision for Comparable Products: Unnamed comparable product may be submitted after award of Contract. Comply with requirements in "Comparable Products" article below.

2.04 BASIS-OF-DESIGN PRODUCTS

A. Where a product is specified by naming a Basis-of-Design, comply with the following:
   1. Where a list of additional manufacturers is provided, provide the Basis-of-Design product or a comparable product by one of the listed manufacturers, in compliance with "Comparable Products" article below.
   2. Where a list of additional manufacturers is not provided, provide the Basis-of-Design product, or submit a substitution request in compliance with Section 012500 - Substitution Procedures.
   3. Basis-of-Design characteristics shall include requirements in the Specifications and on the Drawings.
   4. Where the Basis-of-Design lists a specific finish, manufacturers wishing to submit as a Comparable Product or as a substitution shall certify that they are able to provide an exact match to the specified finish, or that they will provide a custom finish to match.

2.05 COMPARABLE PRODUCTS

A. Where a product is specified with a provision for comparable products, Contractors submitting a Comparable Product shall comply with the following:
   1. The submitted product shall not require changes to the Work, unless specifically approved by Architect. If changes are required, the Contractor shall resubmit the product as a substitution request, and the Contractor shall bear the cost of the changes, coordinate with other impacted contractors, and provide appropriate notations on record documents.
   2. Contractor shall provide, with the submittal, a detailed breakdown comparing the submitted product to at least one of the other listed products; list specified performance qualities, test results, dimensions, finish, and other critical properties.
   3. Contractor shall provide warranty data indicating that submitted Comparable Product complies with indicated warranty term(s).

B. Comparable product submittals are subject to Architect's final approval. If a proposed product is found to be unacceptable, Contractor shall revert to one of the named products.

2.06 COLOR/FINISH OPTIONS

A. Preselected Color/Finish: Where a specific manufacturer's premium or custom finish or color is indicated as the basis-of-design, other listed manufacturers shall certify that they can provide an exact match, or that they will provide pricing under the assumption that a custom finish or color will be required.

B. Color/Finish Selection: Unless specifically indicated to either be a custom color or to be selected from manufacturer's standard range, color and finish selections shall be made from manufacturer's full range of options, including premiums, metallics, wood grains, etc.

2.07 MAINTENANCE MATERIALS

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

B. Deliver to location designated by Owner; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 011000 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:

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

C. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.04 STORAGE AND PROTECTION

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

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.
   1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

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

D. Store with seals and labels intact and legible.

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

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

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

H. Provide off-site storage and protection when site does not permit on-site storage or protection.

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

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

K. Do not store products directly on the ground.

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

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

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

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

END OF SECTION 016000

SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 012000 - Price and Payment Procedures: Final application for payment.

C. Section 015000 - Temporary Facilities and Controls: Temporary exterior enclosures.

D. Section 015000 - Temporary Facilities and Controls: Temporary interior partitions.

E. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

1.02 SUBMITTALS

A. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.

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

1.03 QUALIFICATIONS

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

B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.04 PROJECT CONDITIONS

A. Use of explosives is not permitted.

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

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

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

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

F. Dust and Silica Control: Execute work by methods to minimize raising dust and silica from construction operations. Provide positive means to prevent air-borne dust and silica from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust and silica that is generated outdoors.
   2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

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

1. Minimize amount of bare soil exposed at one time.
2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

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

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

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

K. Hazardous Materials: Do not use materials or products that contain hazardous substances, for permanently installed products and materials, installation materials, or for cleaning or other construction use.

1.05 COORDINATION

A. See Section 011000 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 Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

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

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - 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 LAYING OUT THE WORK

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

B. Promptly notify Architect of any discrepancies discovered.

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

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

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

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

G. Utilize recognized engineering survey practices.

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

I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.

J. Periodically verify layouts by same means.

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

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Fire Safety: Comply with provisions of current version of the International Fire Code, Chapter 33; "Fire Safety During Construction and Demolition" for preventing damage to structures under construction.
   1. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. 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.

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

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

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

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

3.05 ALTERATIONS

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

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000.

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

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Remove miscellaneous hangers, exposed nails not serving as fasteners, and similar protrusions; remove adhesive residue and tape; fill anchorage holes; and otherwise patch and restore surface to be a uniform substrate.
   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; prepare substrate per manufacturer's requirements 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.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access

or provide access panel.

2. Where existing 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 011000 for other limitations on outages and required notifications.
    c. Provide temporary connections as required to maintain existing systems in service.
3. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
    1. Prevent movement of structure; provide shoring and bracing if necessary.
    2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
        a. Use cutting methods such as sawing, drilling, and grinding that do not create impact stresses on existing construction. Do not use striking methods such as chopping or hammering.
    3. Repair adjacent construction and finishes damaged during removal work.

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

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

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

J. Clean existing systems and equipment in all spaces impacted by alteration work.

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

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

3.06 CUTTING AND PATCHING

A. Refer to Alterations article above for additional requirements related to cutting and patching of existing construction.

B. Perform cutting and patching 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.

C. 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 specified condition.

D. Employ skilled and experienced installer to perform cutting and patching.

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

F. Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material to maintain existing fire ratings, to full thickness of the penetrated element.

H. 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.

3.07 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 and silica.

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

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

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

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

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

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

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

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

H. Prohibit traffic from landscaped areas.

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

3.09 SYSTEM STARTUP AND ADJUSTING

A. Coordinate with requirements of Section 019113 - General Commissioning Requirements.

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

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

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

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

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

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

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

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

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

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

3.11 FINAL CLEANING

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

B. Use cleaning materials that are nonhazardous.

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

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

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

F. Replace filters of operating equipment.

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

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

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

3.12 CLOSEOUT PROCEDURES

A. Prior to Substantial Completion, complete the following:
   1. Provide startup, testing, and adjusting of all systems and equipment.
      a. Demonstrate that air and water systems are balanced and that automatic temperature control system is in control of all equipment. This may require separate

demonstrations if controls cannot be tested for applicable seasons of the year.

b. Submit written certification that testing/adjusting/balancing operations have been completed, and that systems are operation and under control in conformance with applicable specification section(s).

c. Submit written certification that all Building Commissioning has been completed.

d. Complete testing of the electronic security and detention systems and equipment, demonstrating security control.

2. Provide all inspections required by local authorities having jurisdiction to obtain Certificate of Occupancy, and provide written certification of completion of Special Inspections.

3. Provide preventive maintenance services for all equipment used prior to Substantial Completion, and provide initial maintenance servicing for all products and equipment that will be subject to ongoing maintenance/service contracts.

4. Provide final cleaning of all products, materials, and equipment, and provide touch up and restoration of exposed materials and finishes.

5. Provide fresh batteries in all battery-powered products and equipment.

6. Provide demonstration and training for Owner's personnel on all required systems and equipment.

7. Coordinate a walkthrough with the Owner and the local fire department and other emergency services.

8. To the maximum extent possible, remove temporary facilities and controls, construction equipment and tools, and similar items that are not part of the finished Work.

9. Coordinate changeover with the Owner of permanent utilities, insurance requirements, and building's permanent keying and lock system.

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

C. 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.

D. Conduct Substantial Completion inspection with representatives of Owner and Architect, 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.

1. At the Architect's sole discretion, based on the amount of outstanding work, the Architect may elect to decline to issue a Certificate of Substantial Completion and will provide a list of outstanding items that are required to obtain Substantial Completion. The Contractor shall request reinspection after the indicated items have been completed.

E. Upon approval, the Architect shall prepare and distribute Certificate of Substantial Completion, and will include a list of outstanding items and Final Correction Punch List.

F. The Owner will occupy the building after Substantial Completion, as specified in Section 011000.

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

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

I. Prior to final completion, complete the following:

1. Ensure that the Certificate of Substantial Completion is fully executed by all required parties.

2. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.
3. Provide final pest and rodent control treatments and inspections.
4. Remove any remaining construction equipment, tools, and materials; perform additional cleaning required due to construction activities following Substantial Completion, and leave the site prepared for Owner occupancy.
5. Submit final demonstration and training materials and videos, as built/record documents, operation and maintenance binders, and warranty binders.
6. Submit final application for payment.

3.13 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.
   1. Contractor's maintenance responsibility shall be through Substantial Completion, unless a longer term is required by individual specification section.

B. Maintenance service shall not be assigned or transferred to any agent or third party without prior written consent of the Owner.

END OF SECTION 017000

SECTION 017419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, incineration, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.

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. Fire Safety: Comply with International Fire Code, Chapter 33 "Fire Safety During Construction and Demolition" and with NFPA 241 for provisions relating to accumulation and removal of combustible debris and waste.

1.02 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.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.

1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
2. Submit Report on a form acceptable to Owner.
3. Landfill Disposal: Include the following information:
    a. Identification of material.
    b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
    c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
    d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
4. Incinerator Disposal: Include the following information:
    a. Identification of material.
    b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
    c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
    d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
5. Recycled and Salvaged Materials: Include the following information for each:
    a. Identification of material, including those retrieved by installer for use on other projects.
    b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
    c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
    d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
    e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: Include the following information for each:
    a. Identification of material and how it was used in the project.

b. Amount, in tons or cubic yards.
c. Include weight tickets as evidence of quantity.

7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES

A. See Section 013000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

2.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to Contractor's site superintendent, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
1. Prebid meeting.
2. Preconstruction meeting.
3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
1. Provide containers as required.
2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Coordinate with Division 2 demolition contractor to properly identify and separate recyclables. Store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Recycling of Existing Carpet: Remove carpet; cut sheet carpet to 4 foot widths, tightly roll, and pack in container. Palletize carpet tiles on 36 inch or smaller pallets; maximum 4 foot high. Tightly bind or shrink wrap packaged carpeting. Include carpet padding where applicable.
1. Coordinate with Division 2 demolition contractor.

2. Coordinate with Division 9 carpet installer to include waste and scrap from new carpet work as applicable.
3. Refer to Carpet America Recovery Effort (CARE) guidelines and ship or deliver carpet to a designated reclamation/recycling facility. https://carpetrecovery.org/

I. Recycling of Existing Acoustical Ceiling Panels: Verify with ACP manufacturer that existing ceiling tiles can be recycled. Following verification, remove and stack ceiling tiles on pallets and wrap or band the pallet loads for pick up or delivery per recycler guidelines.
1. Coordinate with Division 2 demolition contractor.
2. Coordinate with Division 9 ACP manufacturer's recycling program; contact recycler when there is a full trailer load or approx. 30,000 square feet of removed ceiling. Coordinate with recycler to arrange pick up from the project site and transport to recycling facility at no cost.
3. If quantity to be recycled is less than 30,000 square feet, coordinate with ACP manufacturer for delivery to a consolidation point/facility at Contractor's cost.

J. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

K. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 017419

SECTION 017800
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 013000 - Administrative Requirements: Submittal procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect within 15 days after the date of Substantial Completion.

B. Operation and Maintenance Data:

1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within 15 days after acceptance.
2. Submit one PDF draft copy of completed documents within 15 days after the Closeout Conference. This copy will be reviewed and returned, with Architect comments. Revise content of all document sets as required prior to final submission.
3. After revisions are complete, submit one bound hard copy and PDF electronic file of revised final documents in final form within 15 days after Substantial Completion.

C. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 15 days after acceptance.
2. Make other submittals within 15 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 15 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. Addenda.
3. Change Orders and other modifications to the Contract.
4. Miscellaneous record submittals.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

1. Include revised Drawings reissued during Bidding and Construction.

C. Store record documents separate from documents used for construction.
   1. Keep record documents in a location accessible to Architect for periodic review and reference.
   2. Maintain in legible condition. If record document set becomes damaged or excessively dirty, transfer comments to clean set prior to submittal to Architect.

D. Record information concurrent with construction progress.

E. Record Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

F. Miscellaneous Record Submittals: Where other specification sections require completion certifications, or closeout or record submittals, submit in a single binder organized by specification section.

3.02 ASSEMBLY OF RECORD DOCUMENTS

A. Submittal for Architect's Review:
   1. Submit PDF scanned copy of marked up prints.
   2. Architect shall review and provide comment on completeness

B. Submittal for Distribution to Owner:
   1. After Architect has approved for content and completeness, submit PDF scanned copy of final marked up prints, and submit hard copy originals.
   2. Submit full set of Drawings, regardless of whether any modification or markings are on each sheet.

3.03 OPERATION AND MAINTENANCE DATA

A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

B. 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.

C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.04 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   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.

3.05 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. 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 troubleshooting; 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.

3.06 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

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 three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related

consistent groupings.

D. Cover: Identify each binder on front and spine 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.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Photocopies of warranties and bonds.

3.07 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 15 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Retain warranties and bonds until time specified for submittal.

D. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

E. Cover: Identify each binder on front and spine 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.

F. 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.

G. 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.

H. Provide photocopy of each warranty in operation and maintenance manuals; locate each warranty with applicable O&M data for product or equipment.

END OF SECTION 017800

SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products, systems, equipment, and other items where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance of products, systems, equipment, and as otherwise indicated in specific specification sections.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit not less than four weeks prior to start of training.
   2. Revise and resubmit until acceptable.
   3. Provide an overall schedule showing all training sessions.
   4. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such as slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
   1. Identification of each training session, date, time, and duration.
   2. Sign-in sheet showing names and job titles of attendees.
   3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: DVD Disc.
   2. Label each disc and container with session identification and date.
   3. Where available, provide manufacturer's pre-produced training videos in conjunction with live demonstration and training video.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Instructor shall be certified by the manufacturer or fabricator of system.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable, and if acceptable to Owner.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Complete demonstrations within two weeks after the date of Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Complete demonstrations within two weeks after the date of Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site, utilizing installed products and equipment, unless otherwise indicated.

B. Provide training in minimum two hour segments.

C. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

D. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   2. Typical uses of the O&M manuals.

E. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.

4. Discuss cleaning products and procedures, including recommended cleaning products and products that are detrimental to equipment operation or finishes.
5. Provide hands-on training on all operational modes possible and preventive maintenance.
6. Emphasize safe and proper operating requirements; discuss relevant health and safety issues, warning or error indications, and emergency procedures and shutdown.
7. Discuss common troubleshooting problems and solutions. Include minor adjustments for resolving noise, vibration, and improving system efficiency.
8. Discuss any peculiarities of equipment installation or operation.
9. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage. Include discussion of continuing maintenance agreements and procedures.
10. Review recommended tools and spare parts inventory suggestions of manufacturers.
11. Review spare parts and tools required to be furnished by Contractor.
12. Review spare parts suppliers and sources and procurement procedures.

F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 017900

SECTION 018119
INDOOR AIR QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Provide Indoor Air Quality (IAQ) Management Plan to remain in force during the construction period.

B. Chapter 3 of the Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition 2007, available from SMACNA (703-803-2980 or www.smacna.org).

1.02 SUBMITTAL

A. Construction Indoor Air Quality Management Plan (CIAQM Plan).

PART 2 OBJECTIVES DURING CONSTRUCTION

2.01 PROTECTION

A. Store all materials and equipment in a protected area (inside warehouse or storage trailer). Protect materials and equipment that are too large or heavy to store in a trailer from water and dirt/dust/debris.
   1. OPTION: When stored outside, provide two layers of minimum 8-mil poly on the ground and elevate equipment or material a minimum of 4 inches to allow water to run off. Secure top and sides with two layers of 8-mil poly to prevent water penetration and dust/dirt accumulation.

B. Protect HVAC equipment from dust and odors. Do not store equipment in areas near painting, pressure washing, or excavation. Do not operate equipment during cutting or grinding of masonry or concrete.
   1. Refer to Division 23 for construction filter requirements for protection of mechanical duct systems during construction.
   2. Clean ductwork when installed. Cap ends with poly during construction to prevent contamination.
   3. Do not operate HVAC system until the exterior walls, roof, glass, doors and building filters are properly installed.
   4. If air handlers must be used during construction, provide filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 at each air-handling unit. Provide specified prefilters and final filters for operation during construction or install temporary 4-inch MERV 8 filters at each return air grille for operation during construction.
   5. Replace all filtration media immediately prior to Substantial Completion.
      a. Filtration media installed in air-handling units shall have a Minimum Efficiency Reporting Value (MERV) of 8.
   6. Do not perform Testing and Balancing until dust or odor generating activities are completed.

2.02 SOURCE CONTROL

A. Minimize IAQ contaminants introduced by construction materials.

B. Store waste construction materials a minimum of 30 feet away from the building.

C. Do not smoke within 30 feet of the exterior building perimeter.

2.03 PATHWAY INTERRUPTION

A. Provide barriers to contain construction areas to allow a portion of the building to be cleaned and then operate the HVAC system in that cleaned area. Acceptable barriers include dust curtains and temporary walls.
   1. Protect areas of the building in which HVAC is operational by physical barriers from areas of the building not acceptable for operation of the HVAC system.

B. Maintain areas within 30 feet of outdoor air intakes free of dust, dirt, debris, and volatile materials while the HVAC system is in operation.

2.04 HOUSEKEEPING

A. As dust accumulates at the Site, it can become airborne when disturbed by nearby activity. Similarly, spills or excess applications of products containing solvents will increase odors at the Site. Leaving the Site wet or damp for more than a day could result in the growth of mold and bacteria. Therefore, Site cleanup and maintenance is important to maintaining good IAQ during construction.

B. Perform the following to control contaminants at the Site:
   1. Suppress dust with wetting agents or sweeping compounds.
   2. Provide an efficient dust collection method (e.g. a damp rag, wet mop, or vacuum equipped with a high efficiency particulate arrester (HEPA) filter or wet scrubber).
   3. Remove spills or excess applications of solvent-containing products immediately. Provide low-VOC emitting spot removers and cleaning agents near occupied areas.
   4. Remove accumulated water and keep work areas as dry as possible, including the use of dehumidification, if necessary.
   5. Once building is enclosed, vacuum with HEPA filtered vacuum cleaners to prevent settled dust from becoming airborne again.
   6. Protect porous materials from exposure to moisture. Replace items that remain damp for more than four hours.

END OF SECTION 018119

SECTION 018317
EXTERIOR BUILDING ENCLOSURE AIR BARRIER REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes administrative and procedural requirements for accomplishing an airtight building enclosure that controls infiltration or exfiltration of air, including but may not be limited to:
   1. The airtight components of the building enclosure and the joints, junctures and transitions between materials, products, and assemblies forming the air-tightness of the exterior building enclosure shall be “the air barrier system.”
   2. Coordinate between trades, schedule and sequence the Work, and provide preconstruction meetings, inspections, tests, and related actions.
   3. Reports performed by Contractor, independent agencies, and governing authorities.
   4. Construct the building enclosure with a continuous air barrier system to control air leakage into (infiltration) and out of (exfiltration) conditioned spaces. The air barrier system shall have the following characteristics:
      a. Continuous, with all joints sealed.
      b. Structurally supported to withstand positive and negative air pressures applied to the building enclosure.
      c. Connections between:
         1) Foundation and walls.
         2) Walls and windows and doors.
         3) Different wall systems.
         4) Wall and roof.
         5) Walls, floors, and roofs across construction joints, control joints and expansion joints.
         6) Walls, floors and roofs to utility, pipe and duct penetrations.
   5. Make all penetrations of the air barrier membrane or system and paths of air infiltration / exfiltration air-tight.

1.02 RESPONSIBILITIES

A. Contractor responsibilities:
   1. Coordinate affected trades and sequence construction to ensure continuity of the air barrier system, joints, junctures, and transitions between materials and assemblies of materials and products, from substructure to walls to roof.
      a. Coordinate the sequence of activities to accommodate required services with a minimum of delay.
      b. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
   2. Provide quality assurance procedures, testing and verification as required.
      a. Schedule times for inspections, tests, taking samples, and similar activities.
   3. Facilitate inspections, tests, and other quality-control services required.
      a. Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested.
      b. Notify the agency sufficiently in advance of operations to permit assignment of personnel.

c. Services include, but are not limited to, the following:
   1) Provide access to the Work.
   2) Furnish incidental labor and facilities necessary to facilitate inspections and tests.
   3) Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
   4) Deliver samples to testing laboratories.
   5) Provide security and protection of samples and test equipment at the Project Site.

4. Organize pre-installation conference and preconstruction meetings between the trades involved in the whole building's air barrier system to discuss where each trade begins and ends and the responsibility and sequence of installation of all the air-tight joints, junctures, and transitions between materials, products and assemblies of products specified in the different sections, to be installed by the different trades.
5. Provide mockup of exterior wall assembly as required.
6. Coordinate the Work and trades to provide an airtight building enclosure.
   a. Continuity of the air barrier materials and products with joints to provide assemblies.
   b. Continuity of all exterior enclosure assemblies with joints and transition materials to provide an exterior enclosure air barrier system.
   c. Specific quality-control requirements for individual construction activities are also indicated in other applicable sections of the specifications. Ensure each subcontractor is adequately and satisfactorily performing the quality assurance documentation, tests and procedures required by each such section.
   d. Inspections, tests, and related actions do not limit Contractor`s quality-control procedures that facilitate compliance with Contract Document requirements.
   e. Requirements to provide an airtight exterior building enclosure is not limited by quality-control services performed by Architect, Owner, or authorities having jurisdiction and are not limited by provisions of this section.

1.03 PERFORMANCE REQUIREMENTS

A. Materials: Used for the air barrier system in the opaque envelope shall have an air permeance not to exceed 0.004 cfm/ft2 under a pressure differential of 0.3 in. water (1.57psf) (0.02 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2178.

B. Assemblies of materials and components: Shall have an air permeance not to exceed 0.04 cfm/ft2p under a pressure differential of 0.3 in. water (1.57psf) (0.15 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2357.

1.04 SUBMITTALS

A. Submit a written report of each inspection, test, or similar service performed by the air barrier manufacturer's technical representative, to the Owner, Architect, and Contractor.
   1. Report Data: Written reports of each inspection, test, or similar service shall include, but may not be limited to, the following:
      a. Date of issue.
      b. Project title and number.
      c. Name, address, and telephone number of testing agency.
      d. Dates and locations of samples and tests or inspections.
      e. Names of individuals making the inspection or test.
      f. Designation of the Work and test method.
      g. Identification of product and Specification Section.

h. Complete inspection or test data.
i. Test results and an interpretation of test results.
j. Ambient conditions at the time of sample taking and testing.
k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
l. Name and signature of laboratory inspector.
m. Recommendations on retesting.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

A. Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes.

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

C. Repair and protect the Work, regardless of the assignment of responsibility for inspection, testing, or similar services.

AIR BARRIER SYSTEM PRE-INSTALLATION CONFERENCE GUIDE

PURPOSE:

Few building construction components require the coordinated activities of more different trades on the construction, design, and management teams than an air barrier system. Once an air barrier has been covered, any remedies for problems with the components or installation can be costly and time-consuming.

Contractor and subcontractors must have a working knowledge of the air barrier installation, proper sequencing, and must work toward a common goal. Through the use of the integrated mockup panel and this Pre-Installation Conference Guide, gaining such knowledge should be enhanced.

Source: Much of this checklist utilizes content from Tremco's "*Air Barrier Project Management – Pre-Construction Meeting Checklist"* document.

Contractor may request an electronic version of this document for editing purposes and for your use.

Send a copy of this guide to the affected trades and/or attendees so they can attend the Conference prepared to discuss these topics and to fill in as much of this information as possible prior to the meeting, or be prepared to fill them in at the meeting.

CHECKLIST:

Submit and/or complete the following prior to conducting the Pre-Installation Conference. Confirm any additional submittal requirements with the relevant specification sections. Check those items below that you have completed or received "Approved" submittals from the Architect. Delete those that do not apply.

____ Product data	____ Shop drawings	____ Product Certificates
____ Product test reports	____ Installer qualifications	____ Samples
____ Compatibility docs	____ Integrated mockup	____ Quality Assurance Program
____ ABAA certifications	____ Warranty sample	____ _____

____ Air Barrier System Subcontractor reviewed submittals of other indicated/specified trade(s)

MANDATORY ATTENDEES:

Attendance by the following parties and affected trades is mandatory. Identify and ensure any other trades or parties involved or affected by the installation of the air barrier system components are also present. Check those below who actually attend the meeting. Delete those that do not apply.

____ Owner and/or Owner's representative
____ Owner's Testing Agency (if hired to inspect ABS)
____ Air barrier installer / subcontractor
____ Air barrier manufacturer's technical representative
____ Window opening subcontractor
____ Exterior Insulation subcontractor
____ Exterior Metal Panel subcontractor
____ Steel frame (hollow metal) subcontractor
____ _____

____ Architect
____ Contractor
____ Masonry subcontractor
____ Roofing subcontractor
____ Sheathing subcontractor
____ Concrete subcontractor
____ CFSF-S subcontractor
____ Waterproofing subcontractor
____ _____

REVIEW OF RELEVANT PROJECT CONTRACT SPECIFICATION SECTIONS:

Review the Contract Specifications and identify and note any modifications that may be necessary, so all parties understand what is required of them. Submit any modifications via appropriate supplemental documents (FC or PCO). Edit specification sections below to match those of this Project.

SPEC SECTION	MODIFICATIONS (IF ANY)
018317	
072726	
072727	

REVIEW OF RELEVANT PROJECT CONTRACT DRAWINGS:

Review the Contract Drawings and identify and note any modifications that may be necessary, so all parties understand what is required of them. Submit any modifications via appropriate supplemental documents (FC or PCO).

PROJECT CONTRACT DRAWING OR DETAIL NUMBER	MODIFICATIONS (IF ANY)

REVIEW OF RELEVANT PROJECT SHOP / SUBMITTAL DRAWINGS:

Review the submittals and identify and note any modifications that may be necessary, so all parties understand what is required of them. Resubmit those submittals that have not been approved by the Architect.

PROJECT SUBMITTAL / SHOP DRAWING REFERENCE	MODIFICATIONS (IF ANY)

REVIEW OF PRODUCTS:

Review the type of air barrier system that will be provided on the Project and identify each component. Delete those that do not apply.

COMPONENT	ACTUAL PRODUCT TO BE PROVIDED FOR PROJECT
SPF INSULATION – FIELD OF WALL	
SPF INSULATION (WALL) – VOIDS / CRACKS / SHIMS	
SPF INSULATION – FIELD OF ROOF	
FLUID-APPLIED MEMBRANE – PERMEABLE - WALL	
FLUID-APPLIED MEMBRANE – IMPERMEABLE -WALL	
SELF-ADHERED MEMBRANE – PERMEABLE - WALL	
SELF-ADHERED MEMBRANE – IMPERMEABLE -WALL	
SELF-ADHERED MEMBRANE – PERMEABLE - ROOF	
SELF-ADHERED MEMBRANE – IMPERMEABLE -ROOF	
TRANSITION MEMBRANE – SELF-ADHERED	
PRIMER	
MASTIC / TERMINATION SEALANT	

CONSTRUCTION TIE-IN RESPONSIBILITY:

Air barrier systems are successful when a full building envelope/enclosure – without penetrations, voids, holes, gaps, and cracks – is complete. This is critical when numerous trades are involved in the tying-in of the air barrier system to all facets of the exterior building envelope. Utilize the table below to ensure everyone knows who is responsible for the indicated tie-in.

TIE-IN AREA	SUBCONTRACTOR RESPONSIBLE FOR TIE-IN
EXTERIOR FOOTING TO EXTERIOR FOUNDATION WALL	
EXTERIOR FOUNDATION TO EXTERIOR WALL	
SLAB-ON-GRADE TO WALL (EXTERIOR AND INTERIOR)	
SLAB-ON-GRADE JOINTS	
SLAB-ON-GRADE PENETRATIONS	
EXTERIOR WALL TO STEEL FRAME/HOLLOW METAL (E.G., DOORS AND WINDOWS)	
EXTERIOR WALLS TO ALUMINUM FRAMES (E.G., WINDOWS AND LOUVERS)	
DIFFERENT EXTERIOR WALL SYSTEMS (E.G., MASONRY TO METAL)	
EXTERIOR HEAD-OF-WALL TO SLOPING ROOF	
PARAPET WALLS TO ROOF	
EXTERIOR WALL JOINTS	
EXTERIOR SHELF ANGLES	
EXTERIOR STEEL LINTELS	
EXTERIOR WALL PENETRATIONS (E.G., PIPES, DUCTS)	
ROOF PENETRATIONS	
ROOF PERIMETER	

COMPATIBILITY REVIEW:

Each trade/installer shall identify materials that may have potential compatibility issues. For example, some membranes may be subject to decomposing when placed in contact with other materials or components, especially sealants and primers; or may deteriorate if left exposed to the elements and are not protected. Delete those trades/installers that do not apply to this Project.

TRADE / INSTALLER	ISSUES / RESOLUTIONS
AIR BARRIER	
WINDOW	
STEEL FRAME (HOLLOW METAL)	
CFSF-S	
EXTERIOR METAL PANELS	
WATERPROOFING	
MASONRY	
ROOFING	
SHEATHING	
CONCRETE	
INSULATION	
FLEXIBLE FLASHING	
METAL FLASHING	
STRUCTURAL STEEL	

SUBSTRATE PRIMER CONSIDERATIONS:

Indicate whether the substrate for the air barrier material requires the use of a primer, and if so, identify the actual product to be used on the Project. Delete those that do not apply.

SUBSTRATE	YES	NO	PRODUCT
CMU			
SHEATHING			
CONCRETE			
PRECAST			
METAL PANELS			
ROOF SUBSTRATE BOARD			
FLEXIBLE FLASHING			
METAL FLASHING			
WATERPROOFING			
STEEL FRAME / HOLLOW METAL			
STRUCTURAL STEEL			

SUBSTRATE PREPARATION CONSIDERATIONS:

Indicate whether the substrate for the air barrier material requires special treatment or preparation (e.g., flush joints in CMU), and if so, identify the method to be used on the Project. Delete those that do not apply.

SUBSTRATE	YES	NO	METHOD / PROCEDURE	SUBCONTRACTOR RESPONSIBLE
CMU				
SHEATHING				
CONCRETE				
PRECAST				
METAL PANELS				
ROOF SUBSTRATE BOARD				
WINDOW FRAMES				
FLEXIBLE FLASHING				
METAL FLASHING				
WATERPROOFING				
STEEL FRAME / HOLLOW METAL				
STRUCTURAL STEEL				

JOINT CONSIDERATIONS:

It is critical for all joints, gaps, voids, cracks, seams, etc. to be sealed/closed for the air barrier to function properly (based on air barrier manufacturer's instructions). If applicable, indicate the method to be used to close the joints and who is responsible. Delete those that do not apply.

TYPE OF JOINT	METHOD USED TO CLOSE JOINT	SUBCONTRACTOR RESPONSIBLE
CMU		
SHEATHING		
CONCRETE		
PRECAST		
METAL PANELS		
ROOF SUBSTRATE BOARD		
WINDOW FRAMES		
STEEL (HOLLOW METAL) FRAMES		
HEAD-OF-WALL		
OMITTED CMU BLOCK		

INSTALLATION TEMPERATURES:

A major factor in contributing to a successful air barrier system installation is to monitor and install the components within the proper temperature ranges and weather conditions. Indicate below the proper temperature range for each component; the procedure for maintaining the proper temperature range; and the party responsible for maintaining the proper temperature range in accordance with the requirements. Delete those that do not apply.

COMPONENT	PROPER TEMPERATURE RANGE	PROCEDURE AND SUBCONTRACTOR RESPONSIBLE
SPF INSULATION – FIELD OF WALL		
SPF INSULATION (WALL) – VOIDS / CRACKS / SHIMS		
SPF INSULATION – FIELD OF ROOF		
FLUID-APPLIED MEMBRANE – PERMEABLE - WALL		
FLUID-APPLIED MEMBRANE – IMPERMEABLE -WALL		
SELF-ADHERED MEMBRANE – PERMEABLE - WALL		
SELF-ADHERED MEMBRANE – IMPERMEABLE -WALL		
SELF-ADHERED MEMBRANE – PERMEABLE - ROOF		
SELF-ADHERED MEMBRANE – IMPERMEABLE -ROOF		
TRANSITION MEMBRANE – SELF-ADHERED		
PRIMER		
MASTIC / TERMINATION SEALANT		

AIR BARRIER PROTECTION:

The air barrier system shall be protected during construction. Indicate below how the components will be protected (method used), by whom, and when. Delete those that do not apply.

COMPONENT	METHOD USED FOR PROTECTION	SUBCONTRACTOR	WHEN
SPF INSULATION – FIELD OF WALL			
SPF INSULATION (WALL) – VOIDS / CRACKS / SHIMS			
SPF INSULATION – FIELD OF ROOF			
FLUID-APPLIED MEMBRANE – PERMEABLE - WALL			
FLUID-APPLIED MEMBRANE – IMPERMEABLE -WALL			
SELF-ADHERED MEMBRANE – PERMEABLE - WALL			
SELF-ADHERED MEMBRANE – IMPERMEABLE -WALL			
SELF-ADHERED MEMBRANE – PERMEABLE - ROOF			
SELF-ADHERED MEMBRANE – IMPERMEABLE -ROOF			
TRANSITION MEMBRANE – SELF-ADHERED			
PRIMER			
MASTIC / TERMINATION SEALANT			

AIR BARRIER REPAIR:

Discuss how any damage, including but not limited to, accidental holes in the air barrier system, will be repaired – and by whom. Indicate the actual product to be used to perform any repairs in the air barrier components. Delete those that do not apply.

COMPONENT	PRODUCT TO BE USED FOR REPAIR	SUBCONTRACTOR RESPONSIBLE
SPF INSULATION – FIELD OF WALL		
SPF INSULATION (WALL) – VOIDS / CRACKS / SHIMS		
SPF INSULATION – FIELD OF ROOF		
FLUID-APPLIED MEMBRANE – PERMEABLE - WALL		
FLUID-APPLIED MEMBRANE – IMPERMEABLE -WALL		
SELF-ADHERED MEMBRANE – PERMEABLE - WALL		
SELF-ADHERED MEMBRANE – IMPERMEABLE -WALL		
SELF-ADHERED MEMBRANE – PERMEABLE - ROOF		
SELF-ADHERED MEMBRANE – IMPERMEABLE -ROOF		
TRANSITION MEMBRANE – SELF-ADHERED		
PRIMER		
MASTIC / TERMINATION SEALANT		

INSULATION SECURED TO OR OVER AIR BARRIER MATERIAL:

Address any concerns or issues of installing insulation over the air barrier material (foundation, walls, and roof), such as preparation, securing, or fastening methods. Delete those that do not apply.

INSULATION TYPE	METHOD FOR SECUREMENT	CONCERNS (IF ANY)
SPF		
XPS		
POLYISO		
EPS		
EPX		

CFSF-S LOCATIONS: DELETE IF THEY DO NOT APPLY.

Where CFSF-S is a component in the exterior wall assembly, the air barrier installer may need to mark the material itself to indicate where the framing is located. The insulation subcontractor, in turn (when the insulation is not the air barrier), may need to transfer those marks onto the insulation. If any of the above is required, discuss and identify below. Delete those that do not apply.

COMPONENT	SUBCONTRACTOR RESPONSIBLE FOR LOCATION MARKS, IF NECESSARY
SHEATHING	
AIR BARRIER	
INSULATION	

OTHER CONSIDERATIONS OR COMMENTS:

_____

_____

_____

_____

END OF AIR BARRIER SYSTEM PRE-INSTALLATION CONFERENCE GUIDE

END OF SECTION 018317

SECTION 024100
DEMOLITION

PART 1 GENERAL

1.01 DEFINITIONS

A. "Remove": Carefully detach or dismantle items from existing construction and properly dispose of or recycle off site, unless items are indicated to be salvaged or reinstalled.

B. "Salvage" or "Remove and Salvage": Carefully detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition. If indicated to be reinstalled, store in a secure area until ready for reinstallation.

C. "Reinstall" or "Remove and Reinstall": Carefully detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

D. "Existing", "Existing to Remain" or "ETR": Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1. Not all existing construction to remain shall be noted with one of these terms on the Drawings; the intent is to assist the Contractor in areas where it may be difficult to determine. Existing construction shall be assumed to remain unless specifically noted to be removed - either when noted with "remove", "salvage", or "reinstall" terminology per above, or when indicated graphically in accordance with the Demolition Legend on the Demolition Drawings.

1.02 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1. Hold the preinstallation meeting at the Project site; perform a walkthrough to review the existing conditions and highlight areas of particular concern.
2. Review structural concerns and deficiencies in the existing building(s).
3. Review demolition schedule.
4. Review specific elements indicated to remain or to be salvaged, and review procedures for protection and / or storage of those elements.
5. Review Owner's occupancy and noise requirements.

B. Coordination:

1. Coordinate with Division 01 sections for phasing and noise requirements.
2. Owner's personnel shall remove existing equipment and furnishings from spaces to be demolished prior to the beginning of the Work. Any remaining items in the building shall be assumed to be demolished unless specifically noted on the Drawings. The Contractor will not be required to work in furnished areas and will not be responsible for the condition of furniture or equipment left in place.

1.04 SUBMITTALS

A. Photographic Documentation: Submit photographic record of the existing conditions, either as still photographs or as a video-recorded walkthrough. Contractor shall perform walkthrough of existing conditions with Owner's representative prior to site mobilization.

1. Photographic documentation shall clearly show existing damage and wear on existing surfaces that may be interpreted as being caused by subsequent demolition and construction operations.
2. For still photographs, submit marked-up plan(s) indicating locations where photographs were taken and direction photograph is facing. Include a written narrative to describe existing damage and other conditions as deemed necessary.
3. For video recordings, include a spoken narrative to describe locations and existing conditions, or provide a supplementary written narrative.
4. Submit all photographic documentation as digital photo / video files, and supplementary narratives and plans as PDF files. Submit as part of the initial submittal package required prior to release of the first request for payment.

B. Shop Drawings: Submit demolition plans and survey as required by OSHA and local AHJs.
1. Engineering Survey: Provide structural survey of existing building(s). Provide additional surveys if unforeseen conditions are revealed during the course of the Work.
2. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
3. Indicate elements to be salvaged and elements that are to remain in place and protected.

C. Refrigerant Certification: Provide a written statement, signed by refrigerant recovery technician, certifying that refrigerant materials were recovered in accordance with EPA regulations. Statement shall include certified technician's full name and business name as applicable, address, and date of recovery.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Technicians removing or disposing of any equipment or appliance containing ozone-depleting refrigerants shall be certified in accordance with EPA Section 608 Technician Certification.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Perform an initial walkthrough and visual survey of the existing building(s). Take photographic documentation of the existing conditions per submittal requirements above.

B. Perform structural engineering survey of the existing conditions as required by OSHA and local AHJs.

3.02 PREPARATION

A. Remove and salvage items indicated to be reinstalled or turned over to Owner. Clean items and protect in secure packaging, and store in a secure location on-site.

3.03 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. All demolition work shall be considered unclassified. Barring discovery of hazardous materials or undocumented structural components, where elements are indicated to be demolished, the bid price shall be for complete demolition of the element, regardless of the individual component makeup of that element.

B. Refrigerant Recovery: Certified recovery technician shall remove refrigerant from all applicable equipment and appliances prior to the start of demolition activities.

C. Hazardous Materials: Hazardous materials are present in the existing building, and a report is available indicating locations. Do not commence demolition work in an area until written confirmation is received that abatement activities in that area are complete.
   1. Hazardous materials abatement will be performed as part of this Project; refer to abatement requirements elsewhere in the Contract Documents.
   2. If suspected hazardous materials that were not previously documented are discovered during demolition operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

D. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Fire Safety: Comply with applicable requirements of the International Fire Code; Chapter 33, and with NFPA 241.
      a. Use of explosives is not permitted.
      b. Hot Work: Remove all combustibles from areas where hot work is required, including use of cutting torches, welding, or heating equipment. Maintain fire watch for entire duration of hot work and for a minimum 30 minutes after completion of hot work.
         1) Keep portable fire extinguishers within 30 feet of locations where hot work is being performed for entire duration.
      c. Maintain egress routes and emergency access routes at all times; do not allow demolished materials to accumulate and block routes.
      d. Remove combustible demolished materials from the building by the end of each work day. Temporarily store combustible materials in noncombustible containers with self-closing lids until they can be removed from the building.
      e. Do not burn demolished material on site.
   3. 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.
   4. Provide, erect, and maintain temporary barriers and security devices.
   5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   6. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
   7. 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.
   8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

E. Do not begin removal until receipt of notification to proceed from Owner.

F. Do not begin removal until built elements to be salvaged, relocated, or reinstalled have been removed.

G. 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.

H. 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.

I. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Comply with requirements of Section 017419 - 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.

J. If items of potential historic interest are discovered during the course of the Work, such as cornerstones or plaques, consult with the Owner prior to proceeding. If Owner wishes to preserve these items, carefully remove and salvage, and store in on-site location designated by Owner.

3.04 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 Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.05 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. Remove existing work as indicated and required to accomplish new work.
   1. Remove items indicated on drawings.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. 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.
   2. Coordinate with Section 011000 - Summary for limitations on outages and required notifications to Owner, as applicable.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub

and tag with identification.

D. Floor Finishes: After removal of existing floor finishes including backings, underlayments, and thick set mortar beds, remove all residual adhesives and glue. Provide grinding, sanding, or shot-blasting of existing concrete floor slab to achieve the proper surface to receive new indicated floor finish. Coordinate slab surface preparations required for each new indicated floor finish with appropriate subcontractor.

E. Carpet: Coordinate with Division 9 carpet manufacturer and Division 1 Construction Waste Management section for recycling of existing sheet or tile carpet. Remove carpet carefully and remove all loose debris and metal (tacks, nails, stretcher strips). Coordinate with Carpet and Rug Institute guidelines for removal and disposal of adhesives. Cut sheet carpeting and carpet padding into four foot sections and tightly roll and wrap. Stack carpet tile on 36 inch or smaller pallets, no higher than 4 feet, and shrink wrap. Store in a protected, dry location in preparation for delivery to reclamation/recycling facility.

F. Acoustical Ceiling Panels: Coordinate with Division 9 acoustical ceiling panel manufacturer and Division 1 Construction Waste Management section. Remove ceiling tiles and stack neatly on pallets; wrap or band pallet loads. Store in a protected, dry location in preparation for delivery to recycling facility.

G. Concrete: Cut neatly in straight lines with power-driven saw with diamond-tooth blade or other type specifically intended for concrete and masonry. Break up and remove carefully, avoiding damage to adjacent flooring that will remain exposed in the finished work.

H. Masonry: Remove masonry in whole units at exposed surfaces, new openings, and unless otherwise indicated, to allow for toothing-in of new masonry.

1. Solid masonry may be cut with power saw where masonry edges will be concealed by the finished work. Do not cut hollow masonry.

I. Existing Surfaces to Receive Finishes: Remove miscellaneous hangers, exposed nails not serving as fasteners, and similar protrusions; remove adhesive residue and tape; fill anchorage holes; and otherwise patch and restore surface to be a uniform substrate suitable for applied finishes.

3.06 DEBRIS AND WASTE REMOVAL

A. Comply with requirements of 017419 - Construction Waste Management and Disposal.

B. Remove all debris, trash, and other materials not indicated to be salvaged or reinstalled from the site.

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 024100

SECTION 02 41 13 - SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of existing asphalt and/or concrete pavement, concrete and/or asphalt walks, curbs and gutters, and other exterior site items indicated or not indicated which interfere with the Work.
2. Removal and/or relocation of existing underground utilities.
3. Removal and disposal of any noted existing sanitary sewer pipe, water pipe, storm drainage pipe and appurtenances indicated.
4. Removal and replacement of site fencing.
5. Removal and replacement of existing light poles.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to Remain: Protect items indicated to remain against damage and soiling. When permitted by the Owner, items may be removed to a suitable, protected storage location and then cleaned and reinstalled in their original locations.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, remove demolished materials from the site with further disposition at the Contractor's option.

B. Storage or sale of removed items or materials on-site will not be permitted.

C. Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the Work.

B. Record drawings at Project closeout.

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

C. Proposed dust-control measures.

D. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
6. Locations of temporary partitions and means of egress.

E. Inventory of items to be removed and salvaged or turned over to Owner.

F. Landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: All work shall comply with Federal, State and Local laws and regulations concerning hauling and disposal of demolition debris.

B. Notify the proper agencies prior to the start of work and obtain all necessary permits for this work.

1.7 PROJECT CONDITIONS

A. Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner to the extent practical. However, minor variations may occur due to Owner's removal and salvage operations prior to the start of demolition work.

B. The location of existing underground utilities indicated is approximate only. Field locate all existing underground utilities in the area of work, regardless of whether or not they are indicated. Call "Miss Utility" prior to the start of demolition work for assistance in the location of existing underground utilities.

C. Should charted, uncharted or incorrectly charted utilities be encountered during demolition, contact the Owner immediately for instructions. Cooperate with Owner and utility companies to keep services and facilities in operation.

D. Do not interrupt existing utilities serving facilities occupied and used by the Owner and others, except when permitted in writing by the Owner. Provide acceptable temporary utility service as required to maintain Owner's operations.

1.8 SCHEDULING

A. Owner will occupy portions of the building immediately adjacent to the Work. Conduct selective demolition so that the Owner's operations will not be disrupted. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

B. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

C. Notify and coordinate any required relocation and/or removal of existing underground utilities, poles, meters or other above ground appurtenances with the appropriate utility company (i.e. power, telephone, cable and natural gas/propane) prior to the start of selective demolition work.

1.9 PAYMENT FOR UTILITY REMOVAL / RELOCATIONS

A. Electric Service – The Owner will pay for the relocation of

B. Phone Service

C. Cable Television

D. Gas

E. Fiber Optic Lines

F. Petroleum Pipelines

1.10 USE OF EXPLOSIVES

A. Do not use explosives to perform selective site demolition work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Call "Miss Utility" prior to the start of demolition work for assistance in the location of existing underground utilities. Field locate all existing underground utilities in the area of work, regardless of whether or not they are indicated.

B. Should uncharted or incorrectly charted existing utilities be identified, contact the Owner immediately for instructions. Provide a scale drawing with the location of the uncharted or incorrectly charted utilities for use by the Owner in preparing additional direction.

C. Verify that utilities indicated as removed, abandoned and/or relocated have been disconnected and capped.

D. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

E. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged and turned over to the Owner.

3.2 PROTECTION OF PERSONS AND PROPERTY

A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.

D. Barricade areas of demolition occurring as part of this work, and post with warning lights as required by authorities having jurisdiction.

E. Protect structures, buildings, utilities, walks, pavements, existing vegetation and other facilities to remain from damage caused by settlement, lateral movement, undermining, washout and other hazards created by demolition operations.

3.3 POLLUTION CONTROLS

A. Perform all work in accordance with the requirements of the latest edition of the Virginia Erosion and Sediment Control Handbook and those of the local Erosion Control official.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by the Work. Return adjacent areas to condition existing before start of selective demolition.

3.4 DEMOLITION OF EXISTING FACILITIES

A. Electric Service

1. Coordinate the removal and/or relocation of existing utilities with Power Company.
2. Contact Power Company Representative to arrange for required removal and/or relocation of existing service.

B. Phone Service

1. Coordinate the removal and/or relocation of existing utilities with Phone Company.
2. Contact Phone Company Representative to arrange for required removal and/or relocation of existing service.

C. Cable Television

1. Coordinate the removal and/or relocation of existing utilities with Cable Company.
2. Contact Cable Company Representative to arrange for required removal and/or relocation of existing service.

D. Gas

1. Coordinate the removal and/or relocation of existing utilities with Gas Company.
2. Contact Gas Company Representative to arrange for required removal and/or relocation of existing service.

E. Fiber Optic Lines

1. Coordinate the removal and/or relocation of existing utilities with Fiber Optic Company.
2. Contact Fiber Optic Company Representative to arrange for required removal and/or relocation of existing service.

F. Utilities

1. Coordinate the removal and/or relocation of existing utilities with the appropriate utility companies.
2. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and to local jurisdictional codes.
3. Provide adequate means of support and protection during demolition and other construction operations for existing utilities that are to remain in place. Repair utilities damaged by construction operations to the satisfaction of the utility owner.

G. Asphalt Pavement

1. Remove asphalt concrete pavement by sawcutting to the full depth of the pavement. Provide neat sawcuts at the limits of pavement removal indicated.

H. Concrete Pavement, Walks and Curbs

1. Remove concrete pavement and walks to the nearest joint. Sawcut concrete if joints are not present adjacent to the area of demolition.
2. Sawcut concrete along straight lines to a depth of not less than 2 inches. Break out remainder of concrete, provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or sawcut entirely through concrete.

I. Light Poles

1. Remove and relocate light poles as indicated. If light poles are owned by a public utility, coordinate the relocation with them.

.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Do not burn demolished materials or debris.

C. Transport and legally dispose of demolished materials off of Owner's property.

3.6 CLEANUP AND REPAIR

A. Upon completion of demolition work remove all tools, equipment and demolition materials from site. Remove demolition work area protection and leave areas clean.

B. Repair any demolition performed in excess of that required. Return elements of construction and surfaces to remain to the condition existing prior to the start of construction. Repair adjacent construction or surfaces soiled or damaged by demolition work.

END OF SECTION 02 4113

SECTION 028000
HAZARDOUS MATERIALS REMEDIATION

PART 1 GENERAL

1.01 GENERAL

A. Provide hazardous material remediation of asbestos-containing materials (ACM) in strict accordance with applicable laws, ordinances, criteria, rules, guidelines, and regulations of Federal and state authorities governing asbestos abatement, including removing, handling, storing, transporting, and disposing of hazardous waste materials.

B. The ACM to be remediated as part of the contract are identified in the following survey report, included as an appendix at the end of the Project Manual:
   1. "Asbestos and Lead Paint Survey Report" by TRC, dated December 15, 2022.
   2. Note that the survey report includes multiple existing buildings in the commercial shopping center. The Work of this project applies to Building/Space 2032 only. The other buildings on site are existing to remain.

1.02 SUBMITTALS

A. Asbestos Hazard Remediation Plan:
   1. Develop and submit a detailed, job-specific Asbestos Hazard Remediation Plan prepared by an Asbestos Abatement Project Designer, licensed in the state where the project is located. Detail engineering controls and work procedures, including administrative controls, safety precautions, and removal techniques to be used in the abatement of ACM.
   2. Provide a detailed description of the method of containment to ensure that airborne asbestos concentrations as outlined in 29 CFR 1926.1101 are not exceeded in the regulated area.
   3. The plan shall include safety precautions such as lockout, tag out, and equipment work procedures to be used in the removal of ACM. Also include fire and medical emergency response plans.
   4. The plan shall detail housekeeping and hygiene practices and the specific types of protective clothing, equipment, and respirator to be used.
   5. The plan must be approved by Owner prior to starting any remediation work.

B. Permits: Submit copies of required permits.

C. Transport/Disposal Documentations: Submit invoice or manifest from a landfill that has a permit to accept hazardous waste materials; include quantity of hazardous waste accepted.

1.03 QUALITY ASSURANCE

A. Licensing and Training: The Hazardous Materials Subcontractor and all personnel involved in performing asbestos abatement and disposal operations are required to be trained and licensed in the state where the project is located prior to the time of the initial job assignment and in accordance with 29 CFR 1926.1101.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION AND REMEDIATION

A. The Hazardous Materials Subcontractor shall secure all necessary permits, provide necessary notifications, and pay required fees, in conjunction with hazardous material removal, hauling,

and disposal, as required by Federal and state regulations and guidelines. Submit copies of all required permits and hazardous waste manifests to the Owner within 14 days of receipt. Notify the Regional Office of the EPA in accordance with Federal regulation.

B. Conduct remediation in compliance with Federal and state regulations and guidelines.

END OF SECTION 028000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with fly ash or ground granulated blast-furnace slag.

1.3 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Qualification Data: For Installer, manufacturer, testing agency.

C. Welding certificates.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

F. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

G. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

H. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

I. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Waterstops.
5. Curing materials.
6. Floor and slab treatments.
7. Bonding agents.
8. Vapor barriers.
9. Joint-filler strips.
10. Repair materials.

J. Samples: For vapor barriers.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

F. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Quality Control at Epoxy Terrazzo Substrates: Contractor shall establish and provide written quality control concrete slab finishing procedures reviewed by and acceptable to the (096623) epoxy terrazzo flooring manufacturer for (slab on grade) slab areas to receive epoxy terrazzo flooring to maintain the 1/8-inch in 10'-0" tolerance specified. Reduce high spots by approved mechanical means such as shot blast or special grinder. Fill low slab areas with cementitious or epoxy leveling compound acceptable to epoxy terrazzo flooring manufacturer and compatible with epoxy resin to attain level substrate for epoxy terrazzo work. Before concrete slab installation at epoxy terrazzo flooring areas, the General Contractor and installer shall review all screed elevations and spacing, extent of slab pour to help assure quality, and special conditions such as interface to stairs, elevator entrance thresholds and edge of slabs to minimize miscellaneous cracks.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. 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 mixes.
    c. Ready-mix concrete producer.
    d. Concrete subcontractor.

e. Special concrete finish subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, vapor-barrier/vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

3. Verify that the concrete slab will meet the minimum requirements for each special finish.

4. Confirm that the General Contractor through coordination with other trades will be responsible for the protection of the slab during construction to ensure that no contaminants such as (but not limited to) oil, grease, paint, adhesives, flux, etc. will be present at the time of concrete finishing operations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed (weldable).

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I, II, or I/II.
   a. Fly Ash: ASTM C 618, Class F.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Nominal Maximum Aggregate Size: 1 inch

C. Lightweight Aggregate: ASTM C 330, 1 inch nominal maximum aggregate size.

D. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will 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 C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.6 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

2.7 VAPOR BARRIERS

A. Vapor Barrier: A 15 mil vapor barrier meeting or exceeding the requirement of ASTM E 1745 Class A; with a water vapor transmission rate (WVTR) of 0.008 grains/h-sq. ft. or lower when tested in accordance with ASTM E96 or ASTM F1249; and wherein the vapor barrier component (plastic) is no less than 15 mils thick in accordance with ACI 302.1 R-96, and

consists of multi-layer extruded virgin polyolefin plastic. Ungraded polyethylene sheet is not acceptable. Include companion joint tape, mastic, and accessory materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Insulation Solutions, Inc.; Viper VaporCheck II 15-mil.
   b. Poly-America, L.P.; Husky Yellow Guard 15 mil.
   c. Stego Industries, LLC; Stego Wrap 15 mil Class A.
   d. W.R. Meadows, Inc.; Perminator 15 mil.

B. Lap and seal all joints and repair any damage in accordance with manufacturers approved printed instructions.

2.8 BASE COURSE

1. Base Course: Granular, densely-graded "crusher run" material with a balanced fine content, such as VDOT 21A or 21B. The base course shall be compacted and shall be finished to a flat, smooth, low-friction surface.

2.9 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Available Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Euclid Chemical Company (The); "Euco Diamond Hard."
   b. L&M Construction Chemicals, Inc.; "Seal Hard."
   c. Meadows, W. R., Inc.; "Liqui-Hard."
   d. Metalcrete Industries; "Floorsaver."
   e. Nox-Crete Products Group, Kinsman Corporation; "Duro-Nox."

2.10 CURING MATERIALS

A. Terrazzo Floor Areas: Do not use curing agents in areas to receive terrazzo flooring.

B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

D. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

E. Water: Potable.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.11 RELATED MATERIALS

A. Isolation Joint-Filler Strip: ASTM D 1751, pre-formed asphalt-saturated cellulosic fiber, with scored top strip to facilitate installation of sealant. Thickness shall be ½" unless otherwise indicated.

B. Expansion Joint Filler Strip: Pre-formed closed cell polyethelene foam with pressure sensitive adhesive, and scored top strip to facilitate installation of sealant. Thickness shall be ½-inch unless otherwise indicated.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.13 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data basis, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 25 percent.

D. Footings and Piers: Proportion normal-weight concrete mix as follows:

1. Minimum Compressive Strength: As indicated.
2. Maximum Water to Cement Ratio: 0.55.
3. Maximum Slump: 4 inches.
4. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2- to 4-inch slump.

E. Slab-on-Grade: Proportion normal-weight concrete mix as follows:

1. Minimum Compressive Strength: As indicated.
2. Maximum Water to Cement Ratio: 0.51.
3. Maximum Slump. 5 inches.

F. Suspended Slabs on Composite Steel Deck: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated.
2. Slump Limit: 5 inches, plus or minus 1 inch.
3. Maximum Water to Cement Ratio: 0.50.

G. Walls and Piers: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated.
2. Maximum Water to Cement Ratio: 0.50.
3. Maximum Slump: 5 inches, plus or minus 1 inch.
4. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

H. Retaining Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated.
2. Maximum Water to Cement Ratio: 0.50.
3. Maximum Slump: 5 inches.
4. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

I. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 6% with a tolerance of plus 1 or minus 1.5 percent, for exterior concrete only, unless otherwise indicated.

J. Do not air entrain concrete to trowel-finished interior floors, floors to receive dry shake hardener, slabs scheduled to receive epoxy finish or other floor finishes whose manufacturer recommends limited air content, and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

K. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

L. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) 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, and concrete with a water-cementitious materials ratio below 0.50.

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. Chamfer exterior corners and edges of permanently exposed concrete.

G. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 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. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.
2. Install dovetail anchor slots in concrete structures as indicated.

3.3 VAPOR BARRIERS

A. Sheet Vapor Barriers: Place, protect, and repair sheet vapor barrier/retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape and mastic.
2. Seal vapor barrier to vertical interruptions/elements, including foundation walls, columns, and utilities.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Terrazzo Coordination: Locate construction joints at terrazzo floor areas to align with joint and divider locations indicated on terrazzo floor pattern drawing, as approved.

C. 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. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

3. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

D. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

3.6 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

1. Notify the Owner's Testing Agent to permit inspection of sub-base a minimum of 24 hours prior to placement of reinforcing steel and concrete. The Owner's Testing Agent shall inspect and approval all foundation subgrades prior to placing concrete.
2. Notify the Owner's Testing Agent to permit inspection of reinforcing steel a minimum of 24 hours prior to placement of concrete. Notify Owner 24 hours in advance of any scheduled concrete pour.

B. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

E. 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. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.
1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab 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.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    b. Specified overall values of flatness, F(F) 30; with minimum local values of flatness, F(F) 24; for unshored slabs on deck.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Screed, tamp, and trowel finish concrete surfaces.

3.11 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Terrazzo Floor Areas: At areas to receive terrazzo flooring, cure concrete for a minimum of 28 days. Do not use curing agents in areas to receive terrazzo flooring.

C. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

E. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

F. Cure concrete according to ACI 308.1. Method should be coordinated for compatibility with final floor finish by one or a combination of the following:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Do not allow tape of any kind to be applied to or come in contact with a floor slab requiring stain, prior to or after stain has been applied.
    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Liquid curing materials must not be used on concrete scheduled to be stained.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial

application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

B. Verify compatibility with scheduled floor finish.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than twenty-eight days old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

C. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler, where indicated, according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least six months. 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 joint clean and dry.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half 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 in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. 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 will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include 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.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement.

B. Concrete Testing: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days, three at 28 days, and hold one specimen in reserve for test at 56 days.
    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. Strength of each concrete mix 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.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

G. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

H. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

A. 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.

END OF SECTION 033000

SECTION 034500
PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

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

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

F. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).

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

H. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

I. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

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

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

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

M. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.

N. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel.

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

Q. PCI MNL-120 - PCI Design Handbook.

R. PCI MNL-122 - Architectural Precast Concrete: Fully Revised Manual Including New Sections, Extensive Updates, and Detailed Specifications to Meet Today's Construction Needs..

S. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete.

T. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.03 SUBMITTALS

A. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

B. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.
   1. Include special details and shapes such as building corners, window sills, keystones, and others as applicable.
   2. Include joint and reveal sizes, materials, and styles.
   3. Include details of mix designs.
   4. Include structural design calculations.

C. Samples: Provide manufacturer's standard size samples illustrating surface finish, color, and texture.

D. Test Reports: Submit test reports by an independent testing agency, for concrete materials, reinforcing, admixtures, and water-absorption testing.
   1. When approved by Architect, in lieu of test reports, fabricator may submit signed certificates in writing indicating material compliance with requirements.

E. Designer's Qualification Statement.

F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.04 QUALITY ASSURANCE

A. Design Engineer Qualifications: Design precast concrete units, including concrete mixes, reinforcement, anchorages, and supports, 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: Comply with at least one of the following:
   1. Plant certified under Precast/Prestressed Concrete Institute Plant Certification Program; product group and category A1 - Architectural Precast Concrete.
   2. Plant certified under Architectural Precast Association Plant Certification Program for production of architectural precast concrete.

C. Installer Qualifications: Company specializing in performing installation work for architectural precast, including overhead applications; specifically trained or certified by fabricator for installation of architectural precast products.

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.

E. Quality Standards: Comply with requirements of the following publications:
   1. PCI MNL-120 "PCI Design Handbook - Precast and Prestressed Concrete" for design and fabrication requirements.
   2. PCI MNL-117 "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products" for material, forming, testing, finish, and other quality control requirements.
   3. PCI MNL-135 "Tolerance Manual for Precast and Prestressed Concrete Construction" for manufacturing, fabrication, and installation tolerances.

1.05 MOCK-UP

A. See Section 014000 - Quality Requirements for additional requirements.

B. Integrated Exterior Mockup: Attend preinstallation conference and provide precast work for integrated exterior mockup as indicated on Drawings and as specified in Division 1 Section "Quality Requirements."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handling: Lift and support precast units only from support points.

B. Protect units to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Precast Concrete Fabricators:
   1. American Stone Virginia, LLC; Ladysmith, VA.
   2. Arban Precast, Ltd.; Dumfries, VA.
   3. Cast Stone Systems, Inc.; Warrenton, NC.
   4. Gate Precast Company; Oxford, NC.
   5. Metromont Corp.; Richmond, VA/Charlotte, NC/Greenville, SC.
   6. Seaboard Concrete Products Co.; Richmond VA.
   7. Southern Castings, Inc.; Valdosta, GA.
   8. Smith Midland; Midland, VA.
   9. Tindall Corp.; Petersburg VA/Spartanburg, SC.
   10. Substitutions: See Section 016000 - Product Requirements.

2.02 PRECAST UNITS, GENERAL

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
   1. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
   2. Calculate structural properties of units in accordance with ACI 318.
   3. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   4. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

B. Sustainability: Coordinate with Division 01 Section "Sustainable Design Requirements." Provide reports and/or mix designs indicating amount of Portland cement replaced by fly ash, silica fume or other recycled waste material.
   1. Provide information indicating amount of recycled content in steel reinforcing, anchors, inserts, and other metal components.

C. Finish Type: Provide a light sandblast or acid etch finish for a smooth surface texture.
   1. Color: Shall be selected from manufacturer's full range.

2.03 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi).

2.04 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Other Cementitious Materials:
   1. Fly Ash or Natural Pozzolans: Comply with ASTM C618.

C. Fine and Coarse Structural Aggregates: ASTM C33/C33M.

D. Lightweight Structural Aggregate: ASTM C330/C330M.

E. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect from manufacturer's full range.

F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

G. Air Entrainment Admixture: ASTM C260/C260M.

2.05 MORTAR

A. Mortar and Mortar Mix: Comply with Division 04 Section "Unit Masonry" for mortar materials and mixes.

2.06 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.

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.

2.07 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. Maintain consistent quality during manufacture.

F. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

G. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

H. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

I. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

2.08 FABRICATION TOLERANCES

A. Comply with PCI MNL-117 and PCI MNL-135, except as specifically amended below.
   1. Maximum Variation From Nominal Face Dimensions: Plus or minus 3/32 in.
   2. Maximum Variation From Square or Designated Skew: Plus or minus 1/8 inch in 10 feet.
   3. Maximum Variation from Thickness: Plus or minus 1/8 in.
   4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch.
   5. Maximum Bowing of Members: Plus or minus length/360.

2.09 SOURCE QUALITY CONTROL

A. Provide testing and analysis of concrete mix. Testing and analysis may be performed by qualified plant personnel or by third party testing agency.

B. Take concrete test cylinders as required to test for compressive strength, water-cement ratio, and other performance requirements indicated.

C. Take air entrainment test cylinder for each set of exterior concrete test cylinders taken.

D. Take water absorption test in accordance with PCI MNL-117.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.02 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.03 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect units level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. Mechanical Fastening: Secure overhead units (such as lintels), copings, large precast panels, and other precast elements, as determined by fabricator's engineer, with mechanical connections or by welding of cast in anchors/studs to supporting structure, in accordance with fabricator's approved erection drawings.

E. Precast Laid in Mortar: Provide full bed joint at sills, water tables, and similar precast elements. Rake bed joint back for pointing mortar, and point joint slightly concave. Coordinate with flashings, weeps, and other cavity wall materials.

F. Joints Between Precast Pieces or Between Precast and Other Materials:

1. Provide sealant head joints where precast is exposed horizontally or protrudes from wall surface (for example, at all copings, sills, water tables, and similar shapes).
2. Provide sealant joints at expansion and control joints, above shelf angles or other pressure-relieving joints, and at other building joints.
3. Where precast is completely flush to adjacent wall surface (precast accent course without protruding from wall surface), all head and bed joints may be pointed with mortar.
4. Prime precast before installation of sealant, as required by manufacturer for proper adhesion.
5. Provide compressible filler/backer rod and sealant per Division 7 Section "Joint Sealants."
6. Tool all precast joints (mortar and sealant) slightly concave.

G. Exposed Joint Dimension: 1/2 inch. Adjust units so that joint dimensions are within tolerances.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Comply with PCI MNL-135.

3.05 REPAIR ANDCLEANING

A. Repair precast that is damaged during construction to create a uniform match to adjacent precast. If repair is unable to match to the satisfaction of the Owner, remove and replace the damaged piece of precast.

B. Clean precast of soil, mortar, and other stains or markings.

3.06 PROTECTION

A. Protect installed precast concrete from subsequent construction operations.

END OF SECTION 034500

SECTION 042000
UNIT MASONRY

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ACI SP-66 - ACI Detailing Manual.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

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

E. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

F. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

H. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

I. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

J. ASTM C55 - Standard Specification for Concrete Building Brick.

K. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).

L. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

M. ASTM C73 - Standard Specification for Calcium Silicate Brick (Sand-Lime Brick).

N. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.

O. ASTM C91/C91M - Standard Specification for Masonry Cement.

P. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

Q. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

R. ASTM C151 - Standard Test Method for Autoclave Expansion of Hydraulic Cement.

S. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).

T. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

U. ASTM C331/C331M - Standard Specification for Lightweight Aggregates for Concrete Masonry Units.

V. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

W. ASTM C476 - Standard Specification for Grout for Masonry.

X. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

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

Z. ASTM C641 - Standard Test Method for Iron Staining Materials in Lightweight Concrete Aggregates.

AA. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

BB. ASTM C887 - Standard Specification for Packaged, Dry, Combined Materials for Surface Bonding Mortar.

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

DD. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength.

EE. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.

FF. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

GG. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

HH. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry.

II. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing.

JJ. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls.

KK. BIA Technical Notes No. 20 - Cleaning Brickwork.

LL. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls.

MM. BIA Technical Notes No. 46 - Maintenance of Brick Masonry.

NN. NCMA TEK 08-04A - Cleaning Concrete Masonry.

OO. NCMA TEK 10-04 - Crack Control for Concrete Brick and Other Concrete Masonry Veneers.

PP. NCMA TEK 12-01B - Anchors and Ties for Masonry.

QQ. NCMA TEK 12-02B - Joint Reinforcement for Concrete Masonry.

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

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting at the Project site one week before starting work of this section; require attendance by all relevant installers.

1.03 SUBMITTALS

A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

B. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories, for each type of masonry.
   1. Provide elevations indicating steel reinforcing bar locations; provide details of reinforcing including bends and cross-sections, in accordance with ACI SP-66.
   2. Indicate control and expansion joint locations.
   3. Provide flashing details indicating corners, end dams, and other special conditions.
   4. Calcium Silicate Masonry Units: For a substitute product meeting ASTM C90 to be considered, submit shop drawings of all elevations indicating locations of control, expansion, and other movement joints.

C. Samples: Face brick and mortar selections will be verified in mock-up panel. Provide samples of exposed accessories and trim requiring color selection.

D. Material Certificates and Test Reports: Provide manufacturer's certificates and test reports for the following:
   1. Masonry Units:

a. Brick: Size data including fabrication tolerances.
b. Brick: Efflorescence test, per ASTM C67/C67M.
c. Masonry Units: Compressive strength test data.
d. Concrete Masonry: Data indicating aggregates comply with ASTM C33/C33M (normal weight), ASTM C331/C331M (lightweight), and ASTM C618 (fly ash).

2. Mortar and Grout Mixes: Provide description and proportion of materials for each type of mortar and grout.
3. Provide material certificates for each type of metal accessory, including reinforcing bars, joint reinforcement, veneer ties and anchors, and other indicated accessories, indicating compliance with requirements.

E. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Comply with provisions of ACI 530.1/ASCE 6/TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Fire Rated Assemblies: Provide products that comply with fire-resistance ratings indicated as determined by testing according to ASTM E119, by equivalent testing thickness, or by means acceptable to authorities having jurisdiction.

C. Source Limitations for Masonry: Provide each type of masonry unit from a single manufacturer's plant, sourced through a single supplier. Each type of masonry unit shall maintain consistency of color and texture for all product required on the entire project. The approved mockup/sample panel shall be used to determine acceptable color and texture range.

1. Source Limitations for Decorative Concrete Masonry: Provide decorative concrete veneers from a manufacturer with a quality control agreement with water repellant manufacturer, certifying that units have been manufactured with integral water repellant to conform to performance requirements indicated. Provide current certificate from water repellant manufacturer confirming conformance.

D. Source Limitations for Mortar: Provide each mortar mix from a single manufacturer, sourced through a single supplier. Each required mortar mix shall maintain consistency of each component, including cementitious materials and aggregate, to provide consistent color and texture fr all product required on the entire project. The approved mockup/sample panel shall be used to determine acceptable color and texture range.

E. Aggregate for Concrete Masonry Units: If bottom ash is used as aggregate in the CMU, the Source for the bottom ash shall be a power station that has a minimum of ten (10) years continuous experience as a supplier of quality material as verified by independent certified laboratory testing and no defects in the marketplace.

F. Pre-Construction Testing: Owner shall engage an independent testing agency to perform field quality control tests, in accordance with Section 014000 - Quality Requirements.

1. Clay Masonry Unit Tests: Testing agency shall test each variety of clay masonry in accordance with ASTM C67/C67M compressive strength requirements.
2. Concrete Masonry Unit Tests: Testing agency shall test each variety of concrete unit masonry in accordance with ASTM C140/C140M compressive strength requirements.

1.05 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Integrated Exterior Mockups: Attend preinstallation conference and provide masonry work for integrated exterior mockup as indicated on Drawings and as specified in Division 1 Section "Quality Requirements."

1.06 FIELD CONDITIONS

A. Wall Cavity Protection: Provide temporary waterproof sheet coverings over masonry walls at top of walls, sills, parapets, and other horizontal projections. Install coverings at end of each workday, when rain or precipitation is expected, and after masonry work is completed.
   1. Extend coverings down vertically at least 24 inches on each side of masonry wall. At multi-wythe walls where one wythe is more than 24 inches taller than other wythe(s), extend covering as required to fully cover all wythes and cavities.
      a. At roof parapets, extend covering on rear side of parapet full height down to roof deck/membrane, until vertical protection/roof membrane is installed.
   2. Secure all coverings in place with tape or adhesive that does not leave residue, or other securement method that does not penetrate or damage permanent construction.
   3. Provide protective coverings at sills and horizontal projections that can also serve as protection from mortar droppings.
   4. Provide protective coverings over tops of foundation walls containing insulation to protect from exposure to sun and from construction traffic damage.
   5. Do not remove or allow removal of temporary covers until permanent top of wall protection elements (coping, sill, roof surface, waterproof membrane, etc) are underway.

B. Cold- and Hot-Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

1.07 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 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 and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide nonstandard blocks configured for corners, lintels, headers, other detailed conditions, and as indicated below.
      a. Provide bullnose units for outside corners.
      b. Provide solid block with bullnosed top edges at free-standing CMU walls and where top of block is exposed at window sills and similar applications.
   3. Concrete Masonry Units: ASTM C90, lightweight.
      a. Exposed Faces: Manufacturer's standard color and texture.
      b. Aggregates:
         1) Lightweight Aggregates: Lightweight aggregate shall strictly comply with ASTM C331/C331M, ASTM C151, and ASTM C641. Drying shrinkage of aggregate shall not exceed 0.10% at 100 days.
         2) Waste concrete, scoria, and aglite shall not be permitted.
   4. Decorative Concrete Block: ASTM C90, normal weight.
      a. Pattern: Manufacturer's standard ground-face pattern.
      b. Size: Match standard nominal dimensions per "Concrete Block" paragraph above.
      c. Color: To be selected by Architect from manufacturer's full range.

d. Provide integral water repellent and companion mortar additive at all exterior decorative CMU.
e. Topcoat: Where recommended by manufacturer of ground-face units, provide clear acrylic top-coat, minimum 20 percent solids content.

5. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at the time of manufacture.
   a. Performance of Units with Integral Water Repellent:
      1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
         (a) No water visible on back of wall above flashing at the end of 24 hours.
         (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
         (c) No more than 25 percent of wall area above flashing visibly damp at end of test.
      2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
      3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
   b. Use only in combination with mortar that also has integral water repellent admixture.
   c. Use water repellent admixtures for masonry units and mortar by a single manufacturer.
   d. Available Products:
      1) ACM Chemistries; RainBloc.
      2) BASF Aktiengesellschaft; Rheopel Plus.
      3) Grace Construction Products (W.R. Grace & Co.); Dry-Block.

B. Concrete Brick:
   1. Actual Size: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
   2. Concrete Building Brick: ASTM C55; lightweight, solid, for interior or concealed use.

2.02 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS or FBX, Grade SW.
   1. Actual Size: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long (modular).
   2. Special Shapes: Molded units (plant-fabricated) as required by conditions indicated, unless standard units can be sawn to produce equivalent effect. Cut or sawn edges shall not be exposed in the finished work.
   3. Efflorescence: Provide brick that has been tested per ASTM C67/C67M and received a rating of "not effloresced."

B. Building (Common) Brick: ASTM C62, Grade SW, except MW may be used in locations indicated acceptable in reference standard; solid units.
   1. Actual size: Match face brick.
   2. Locations: May be used in concealed locations in lieu of face brick.

2.03 CALCIUM-SILICATE (SAND-LIME) MASONRY UNITS

A. Sand-Lime Brick: ASTM C73, Grade SW; solid units that have been pressure formed and autoclaved; 3-5/8-inch bed depth..
   1. Actual Size: 11-5/8 inches high; 3-5/8 inch depth; 23-5/8 inches long.
      a. Where multiple sizes are indicated, refer to Drawings for layout and location of each size of unit.
      b. Provide special shapes as indicated.

2. Texture: Smooth finish on exposed faces and ends.
3. Corners: Provide end return at corners; end finish shall match face texture indicated.
4. Fabrication Tolerances:
   a. Unit Length and Height: Plus or minus 1/16 inch.
   b. Deviation from Square: Plus or minus 1/16 inch, with measurement taken using hte longest edge as the base.
   c. Bed Depth: Plus or minus 1/8 inch.
   d. Custom Unit Dimensions: Plus or minus 1/8 inch.
5. Physical Characteristics:
   a. Average Compressive Strength, Brick Method: 8500 psi; per ASTM C67/C67M
   b. Average Compressive Strength, Dimension Stone Method: 6600 psi; per ASTM C170.
   c. Average Modulus of Rupture: 770 psi; per ASTM C99.
   d. Average Absorption Rate: 8.8 percent; per ASTM C97.
   e. Average Density: 129 lbs/ft^3; per ASTM C97.
6. Products:
   a. Basis-of-Design Product: Arriscraft; Renaissance Stone.
      1) Color: 'Cafe'; Fort Valley, Georgia plant.
   b. Provide matching dolomitic limestone courses where calcium silicate is indicated at or below grade. Basis-of-Design: Arriscraft "Adair" Limestone.
   c. Subsitutions: Substitutions will be accepted if proper consideration is made by the bidder and contractor to accommodate for the different physical properties of the substitutes in comparison to the base bid material of Calcium Silicate Masonry Units. Any Unit considered for substitution must have tolerances that match Calcium Silicate Masonry Unit Tolerances to be accepted. Products below meet the ASTM C90 Concrete Block standard and shall be installed per NCMA TEK Bulletins and Notes, including horizontal joint reinforcement, control joints, and other installation criteria for movement and crack control. Available ASTM C90 products:
      1) General Shale Company; Regency Stone.
      2) Indiana Cast Stone; Cast Stone Masonry Units.
      3) Reading Rock, Inc; RockCast.

2.04 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M.
   1. Colored Mortar: Premixed cement as required to match Architect's color sample.
   2. Available Products:
      a. Argos USA; Magnolia Masonry Cement.
      b. Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
      c. Lehigh Hanson; flamingo Colored Cement.
      d. Roanoke Cement; a division of Titan America; Colored Masonry Cement.
      e. York Building Products, a Stewart Company; Workrite Colored Masonry Cement.
      f. Substitutions: See Section 016000 - Product Requirements.
B. Surface Bonding Mortar (Parge Coat): ASTM C887.
C. Mortar Aggregate: ASTM C144.
D. Grout Aggregate: ASTM C404.
E. Water: Clean and potable.

F. Accelerating Admixture: ASTM C494/C494M, Type C; nonchloride, noncorrosive type for use in cold weather; approved by manufacturer for use in masonry mortar.

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 DAMPPROOFING

A. General: Dampproofing may be provided as a Contractor option to parge coat, applied to exterior face of below grade CMU back up wall (prior to insulation or grouting).

B. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Emulsified Asphalt Coating (Brush or Spray Applied): ASTM D1227/D1227M, Type II, Class 1 - Mineral colloid emulsifying agents with non-asbestos fibers or Type III, Class 1 - Mineral colloid emulsifying agents without fibrous reinforcement.
   2. Accessory Materials: Provide asphaltic primer, glass fiber reinforcement, and compatible patching compounds as required and as recommended by manufacturer.
   3. Manufacturers:
      a. Henry Company.
      b. Karnak Corporation.
      c. Mar-Flex Systems, Inc.
      d. W. R. Meadows, Inc.
      e. Substitutions: See Section 016000 - Product Requirements.

2.06 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.

B. Joint Reinforcement, Anchorage, and Ties, General: Comply with NCMA TEK 12-02B, NCMA TEK 12-01B, and requirements below.
   1. Use ladder type joint reinforcement, unless otherwise indicated. Truss type reinforcement may be used only when approved by Architect, at walls indicated not to have vertical reinforcing steel and not to be grouted.
   2. Provide prefabricated joint reinforcement sections for corners and for T-intersections.
   3. Provide joint reinforcement in minimum 10 foot lengths.
   4. At multi-wythe/cavity wall applications, size all anchors, ties, and reinforcement for depths of cavities indicated, including indicated insulation thickness as applicable. Ties shall maintain full adjustability at veneer wythe without affecting insulation.
   5. At cavities with air space wider than 4-1/2 inches, provide high strength ties engineered for cavity depths indicated.

C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Material: Mill-galvanized steel for interior walls, hot-dip galvanized steel for exterior walls.
   2. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

D. Multiple Wythe Joint Reinforcement: ASTM A951/A951M. Provide at composite walls and subgrade walls where all wythes are of the same material.
   1. Material: Mill-galvanized steel for interior walls, hot-dip galvanized steel for exterior walls.
   2. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
      a. Provide two side rods for each wythe that is nominal 6-inch depth or greater, and one side rod for each wythe that is nominal 4-inch depth.

E. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M. Provide at cavity walls/masonry veneer walls.
   1. Type: Ladder, with adjustable ties or tabs spaced at 16 in on center.
   2. Material: Hot-dip galvanized steel.
   3. Size: 0.1483 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire, width of components as required to extend at least halfway through veneer wythe, but provide not less than 5/8 inch of mortar coverage from each masonry face.
   4. Vertical adjustment: Not more than 1 1/4 inches.

F. Strap Anchors: Bent steel shapes, 1-1/2 inch width, 0.105 inch thick, 24 inch length, with 2 inch long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.

G. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
   1. For Anchorage to Structural Steel Framing: Crimped wire anchors for welding to frame, 0.25 inch thick, with triangular/trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

H. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B. Provide at masonry veneer walls with metal framing backup. At cavity walls with CMU backup and masonry veneer, masonry veneer anchors may be used in conjunction with standard horizontal joint reinforcing, at Contractor's option, in lieu of adjustable multiple wythe joint reinforcement.
   1. Anchor Plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners.
   2. Wire Ties: Manufacturer's standard shape, 0.1875 inch thick.
      a. Size wire ties to extend at least halfway through veneer wythe, but provide not less than 5/8 inch of mortar coverage from masonry face.
   3. Vertical Adjustment: Not less than 3-1/2 inches.
   4. Products:
      a. Construction Tie Products; CTP-16.
      b. Heckmann Building Products; 213 + 263.
      c. Hohmann & Barnard; HB-213-2x.
      d. Wire Bond; RJ-711.

I. Metal-to-Metal Fasteners (for Steel Studs): Self-drilling, self-tapping #10 hex screws; fabricated of either 304 stainless steel or of steel with corrosion resistant polymer coating tested to ASTM B117. Fasteners shall include integral neoprene or EPDM washer.
   1. Products:
      a. ELCO Construction Products; Dril-Flex with Stalgard Finish.
      b. Heckmann Building Products; #668 TEK Self-Drilling Steel Stud Screw.

c. ITW Commercial Construction North America; Teks Maxiseal with Climaseal Finish, or Scots Long Life Teks (stainless steel).

2.07 FLASHINGS

A. Combination Non-Asphaltic Flashing Materials - Stainless Steel:
   1. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.
      a. Manufacturers:
         1) Hohmann & Barnard, Inc; Mighty-Flash Stainless Flashing.
         2) Prosoco; R-Guard SS ThruWall.
         3) STS Coatings; Wall Guardian Stainless Steel TWF.
         4) York Manufacturing, Inc; Multi-Flash SS.

B. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.

C. Termination Bars: One-inch wide, fabricated of 0.125-inch PVC, 0.090-inch extruded aluminum, or 0.075-inch stainless steel; compatible with membrane and adhesives.

D. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.

E. Flashing Sealant/Adhesive/Liquid Seam Tape: Polyether-based, 100% solids, moisture-curing elastomeric products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates; and that are compatible with asphalt-free flashing materials and air barrier materials. Traditional mastic is not acceptable.
   1. Available Products:
      a. Master Builders Solutions; MasterSeal NP150.
      b. STS Coatings; GreatSeal LT-100 Liquid Tape.
      c. York; UniverSeal US-100 Liquid Tape.

2.08 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Provide nominal 2.5-inch "standard" and "tee" configurations to suit application unless indicated otherwise.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations. Provide in depth matching cavity depth without gap at front or back of mesh. Fabricate approximately 10 inches high with minimum 6 inch high dovetail shape projections.
      a. Available Products:
         1) Advanced Building Products, Inc; Mortar Break DT.
         2) Heckmann Building Products; WallDefender.
         3) Hohmann & Barnard, Inc.; Mortar Trap.
         4) Mortar Net Solutions; MortarNet.
         5) Wire-Bond; Cavity Net DT (3611D).
      b. At cavities with depth greater than 2 inches, provide companion drainage product by one of the manufacturers above; nominal 1/2-inch thickness by 20 inches wide, to be

field inserted into cavity in a "U" configuration. Basis-of-Design is "Mortar Catch 352" by Advanced Building Products, Inc.

D. Bond Break: ASTM D226/D226M, Type I ("No.15") asphalt felt or polyethylene tape.

E. Weeps/Cavity Vents:
   1. Cellular Type: Extruded propylene with honeycomb design.
      a. Color(s): To be selected by Architect from manufacturer's full range.
      b. Available Products:
         1) Advanced Building Products, Inc.; Mortar Break weep mesh.
         2) Blok-Lok Limited; Cell-Vent.
         3) CavClear/Archovations, Inc.; CavClear Weep Vent.
         4) Heckmann Building Products Inc.; No. 85 Cell Vent.
         5) Hohmann & Barnard, Inc.; Quadro-Vent.
         6) Mortar Net Solutions; WeepVent.
         7) Wire-Bond; Cell Vent.
   2. Bed Joint Weep System: Corrugated plastic drainage system incorporating continuous drainage strip within cavity portion of wall with integral weephole extensions at 9-1/2 inches on center located above flashing in the bed joint of the veneer masonry. Provide at masonry units over 32 inches long, and as indicated.
      a. Available Products:
         1) Heckmann Building Products; Core/Cavity Vent Weep System #367.
         2) Masonry Technology Incorporated (MTI); Cavity Weep CV 5010.

F. Reinforcing Positioners: Provide wire positioners in bed joints to keep steel reinforcing bars centered in cells, fabricated of 0.1483-inch hot-dip galvanized steel wire.
   1. Available Products:
      a. Heckmann Building Products, Inc.; No. 376 Rebar Positioner.
      b. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
      c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.09 LINTELS

A. Masonry Lintels: Fabricated of bond beam CMUs, with texture matching adjacent standard CMU. Provide reinforcing bars and grout in accordance with structural requirements. Provide temporary supports until cured.

B. Precast Concrete Lintels: Comply with structural requirements for concrete strength and reinforcing. Precast U-lintels fabricated in accordance with performance standards of PCI MNL-116 with 3500 psi concrete for standard lintels and 6000 psi concrete for prestressed lintels as manufactured by Cast-Crete are acceptable in lieu of rectangular section lintels.

C. Steel Lintels: Refer to Section 055000 - Metal Fabrications.

2.10 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Reinforced masonry: Type S.
   3. Mortar parge coats: Type S.
   4. Exterior, loadbearing and non-loadbearing, and interior, loadbearing and non-loadbearing: Type N, except as indicated above.

a. Interior, non-loadbearing masonry may use Type O at Contractor's option.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
   1. Use colored mortar for all veneer masonry. Separate colors shall be required for each type and color of veneer.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

D. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

E. 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 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. For installation in cold or hot weather, comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 GENERAL INSTALLATION REQUIREMENTS

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.
   1. CMU Coursing: One unit and one mortar joint equal 8 inches.
   2. Brick Coursing: Either two or three units with accompanying mortar joints shall equal 8 inches, based on basis-of-design brick size(s) indicated above.

C. Provide running bond for all masonry units unless otherwise indicated.

D. Tool all mortar joints slightly concave where they will be exposed, unless otherwise indicated.
   1. Provide flush joints where they will be concealed by surface-applied treatments or finishes other than paint; including but not limited to tile, wall coverings, fluid-applied or SPF air barriers, or membranes.

E. Calcium Silicate Masonry Units: If substituting for the Basis-of-Design product with a concrete based product meeting ASTM C90, installation must meet the following requirements in addition to general installation requirements of this section:
   1. Provide additional control, expansion, and movement joints to comply with requirements of NCMA TEK 10-04.
   2. Horizontal joint reinforcement shall be spaced at no more than 16 inches O.C. vertically per NCMA TEK 10-04.

3. Provide continuous bond breaker material between clay masonry and units meeting ASTM C90 standard.
4. 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.

3.05 PLACING AND BONDING

A. Remove broken, cracked, chipped, or otherwise damaged masonry units from pallets and set aside. Do not use unless they may be field cut to remove damaged section, for installation where special shape is required to fit construction.

B. Create a consistent blend for each type of veneer masonry by mixing units from a minimum of three pallets.

C. Provide asphalt felt or polyethylene tape bond-breaker between clay masonry and concrete or other masonry types. Rake back joints for sealant.

D. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

E. Lay hollow masonry units with face shell bedding on head and bed joints.

F. Remove excess mortar and mortar smears as work progresses.

G. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

H. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

I. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
   1. Do not cut masonry unless it is required for certain shapes, such as rowlock sills, or unless it is unavoidable due to fitting around other construction, such as wall penetrations.
   2. Cut masonry edges shall not be visible in the final work. Where special shapes are required that would expose cut edges, they shall be plant-fabricated.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. At parapets and below-grade/foundations, provide joint reinforcement at 8 inches o.c. vertically.

E. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

F. Lap joint reinforcement ends minimum 6 inches.

G. Do not extend reinforcement across control, expansion, and other building movement joints.

H. Reinforce corners and intersections with prefabricated T- or L-shaped reinforcing.

I. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

J. Embed ties and anchors in mortar joint and extend at least halfway through masonry veneer unit; with at least 5/8 inch mortar cover to the outside face of the anchor.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry and/or Metal Framing Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.10 REINFORCEMENT AND ANCHORAGES - COMPOSITE UNIT MASONRY

A. Install continuous horizontal joint reinforcement at 16 inches o.c. vertically, except at below grade foundation walls install at 8 inches o.c. vertically.

B. Where concrete foundations are indicated, tie below-grade masonry to concrete with rigid anchors spaced at maximum 8 inches o.c. vertically.

C. Coordinate with parging/dampproofing and with installation of insulation, where indicated.

3.11 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Remove or cover protrusions or sharp edges that could puncture flashings.
   2. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 16 inches minimum on vertical surface of backing:
   1. Anchor vertical leg of flashing into backing with a termination bar and sealant.

C. Extend metal flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.
   1. Notch and hem exterior corners of drip edges to eliminate sharp, exposed cut metal edges at locations below 6' - 0" above grade.

D. Support flexible flashings across gaps and openings.

E. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.12 LINTELS

A. Comply with requirements on Structural Drawings for type of lintel at each opening, additional lintel sizing, reinforcement, and installation requirements.

B. Install loose steel or precast lintels over openings, where indicated.

C. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
   1. Allow masonry lintels to attain specified strength before removing temporary supports.

D. Maintain minimum 8 inch bearing on each side of opening, unless otherwise indicated.

3.13 GROUTED COMPONENTS

A. Comply with requirements on Structural Drawings for locations of structural grouted components and accessories, including but not limited to, grouted bond beams, reinforced unit masonry walls, (including locations and sizing of vertical steel bar reinforcing), grouted solid CMU, and composite wall collar joints.

B. Lap splices minimum 24 bar diameters.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

D. Place and consolidate grout fill without displacing reinforcing.

3.14 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. Provide control and expansion joints at locations indicated on Drawings, and as follows:
   1. At changes in wall height.
   2. At changes in wall thickness
   3. At change in support (eg: transition from foundation support to floor slab support).
   4. Adjacent to corners of walls within a distance equal to no more than half the maximum control joint spacing.
   5. Wall intersections.
   6. Do not place control joints closer than 16 inches to edge of wall openings (doors, windows, louvers, ducts).
   7. Distance between joints shall not exceed a length to height ratio of 1.5:1.
   8. Distance between joints shall not exceed 25 feet where no openings occur between joints.
   9. Distance between joints shall not exceed 20 feet where openings occur between joints.

3.15 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Mix mortar (or grout) to a 4-inch maximum slump consistency and hand trowel into place in accordance with Steel Door Institute (SDI-100).
   2. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.16 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.17 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, and other penetrations. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.18 PARGING

A. Dampen masonry walls prior to parging.

B. Parge cavity side of CMU below grade back-up wythe with a single coat of surface-bonding mortar to a total thickness of 1/4 inch.

1. In lieu of parging, Contractor may at its option apply bituminous dampproofing, at a minimum rate of 1.25 gal per 100 sq. ft. Apply primer if required by manufacturer and comply with manufacturer's installation requirements.

C. Steel trowel surface smooth and flat with a maximum surface variation of 1/8 inch per foot.

D. Strike top edge of parging at 45 degrees.

3.19 FIELD QUALITY CONTROL

A. Field Inspection: The Owner shall engage an independent inspection agency to perform field quality control inspections and prepare field reports.

1. The Contractor shall permit full access to inspectors in order to perform inspections, including use of temporary facilities and equipment such as scaffolding or lifts.
2. Do not enclose cavities or spaces to be grouted solid until inspections have approved grout and reinforcement for material properties, size, and installation locations.

B. Field Testing: The Owner shall engage an independent testing agency to perform field quality control tests, as specified in Section 014000 - Quality Requirements. For each type of masonry unit, 5 randomly chosen units shall be sampled for each 5,000 square feet of wall.

1. Clay Masonry Unit Tests: Testing agency shall test each variety of clay masonry in accordance with ASTM C67/C67M requirements.
2. Concrete Masonry Unit Tests: Testing agency shall test each variety of concrete unit masonry, of each load-bearing size indicated, in accordance with ASTM C140/C140M requirements.
3. Mortar Tests: Testing agency shall test each type of mortar in accordance with ASTM C780. Mortar shall be tested on each of the first 3 days. Alert testing agency if mortar mix is altered during construction to allow for retesting.
4. Grout Test: Testing agency shall test each type of grout in accordance with ASTM C1019. Grout shall be tested on each of the first 3 days. Alert testing agency if grout mix is altered during construction to allow for retesting.

3.20 REPAIR AND CLEANING

A. Remove masonry units that have become damaged or stained, or that do not display acceptable blend of color and texture matching mockup/sample panel. Remove as whole units, do not cut. Replace with new units with fresh mortar joints.

B. Remove excess mortar and mortar droppings.

C. Replace defective mortar and repoint. Enlarge holes or voids at defective mortar, and remove enough adjacent mortar to allow for repointing. Install fresh mortar joint and match to adjacent work.

D. Where expansion/control joints and sealant joints are indicated, clean joints and leave them clear and ready for installation of joint or sealant materials.

E. Clean concrete masonry in accordance with NCMA TEK 08-04A and clean clay masonry in accordance with BIA Technical Notes No. 20. Use hand cleaning/bucket-and-brush methods.

F. To prevent freezing of cleaners and rinse water, do not clean when masonry surface temperature will drop below 40 degrees F.

G. Test cleaning methods and materials on one half of mockup/sample panel; leave the other half uncleaned. Obtain approval of Architect before cleaning the finished work.

H. Protect adjacent non-masonry surfaces from cleaning materials and processes with temporary sheeting or masking.

I. Provide "in-progress" cleaning; clean masonry in each area as soon as possible after mortar has fully cured (approximately 7 to 28 days; coordinate with manufacturer's recommendations for each mortar type specified). Field test a small area to ensure mortar curing is complete prior to large-scale cleaning.

J. Pre-wet masonry surfaces and clean with specified cleaning solution. Rinse surfaces immediately after cleaning; do not allow cleaning solution to dry or set into the masonry.

K. Use non-metallic tools in cleaning operations.

L. Final Cleaning: As part of Project Closeout (prior to Substantial Completion), provide Final Cleaning of masonry veneer. Remove construction dust with a very low pressure rinse. Perform a visual inspection and spot clean to remove efflorescence, staining, or organic growth, in accordance with recommendations of BIA and NCMA technical notes.

3.21 PROTECTION

A. Provide temporary protective waterproof sheet coverings over tops of walls, parapets, sills, and other horizontal projections as the work progresses, in accordance with FIELD CONDITIONS article in Part 1 above.

B. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

C. Provide protective vertical boards and horizontal sheeting at grade level base of walls to prevent staining or splashing from rain, mud, or mortar droppings.

3.22 MASONRY WASTE

A. Fill Material: Clean masonry waste may be used as fill material. Break up masonry waste into small pieces no greater than 4 inches any direction. Mix with Division 31 engineered fill material so that masonry waste is no more than 33% of the fill (1 part masonry waste, 2 parts engineered fill). Fill containing masonry waste shall be at least 18 inches below grade level.

1. Excess waste shall be removed and disposed of or recycled in accordance with Division 1 waste disposal requirements.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract and of the Contract documents apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural steel connections, required by the Contract Documents to be selected or completed by the fabricator, to withstand design loadings indicated.

B. Recycled Content: Provide products with a minimum post-consumer recycled content of 75%.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

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.
5. For structural-steel moment connections, diagonal brace connections, and connections at collectors with transfer forces, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Professional Engineer shall be licensed in the Commonwealth of Virginia.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer, fabricator, professional engineer, and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.

2. Tension-control, high-strength bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Fabricator shall participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant, Category STD, or shall employ an approved independent inspection or quality control agency to conduct periodic, in plant inspections at the fabricator's plant at a frequency that will assure the fabricator's conformance to the requirements of the inspection agency's approved quality control program, as required by the VUSBC.

B. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Preinstallation Conference: Conduct conference at Project site.

1.6 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 F 1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

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.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992, Grade 50

B. Channels, Angles, M -Shapes: ASTM A 36

C. Plate and Bar: ASTM A 36

D. Cold-Formed Hollow Structural Sections (HSS): ASTM A 500, Grade B structural tubing.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

1. Weight Class: Standard
2. Finish: Black except where indicated to be galvanized

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36

1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy-hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish: Plain.

E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36 carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Plain.

F. Threaded Rods: ASTM A 36.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Washers: ASTM A 36 carbon steel.
3. Finish: Plain.

2.3 PRIMER

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

C. Galvanizing Repair Paint: ASTM A 780.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. 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.

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 according to SSPC-SP 1, "Solvent Cleaning ."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 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 to receive sprayed fire-resistive materials (applied fireproofing).
4. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning" or SP 3, "Power Tool Cleaning" (Concealed Steel)
2. SSPC-SP 6, "Commercial Blast Cleaning" (Exposed Steel – Exterior and Interior)

C. Priming: Immediately after surface preparation, apply primer according to 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.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels in exterior walls and all exterior structural steel not scheduled to receive finish paint.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner's independent testing and inspecting agency may perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections may be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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.

1. Do not remove temporary shoring supporting composite deck construction 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 according to AISC 303 and AISC 360.

B. Base, Bearing 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 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 shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 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[and AWS D1.8/D1.8M] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs at exposed steel, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

1. The independent testing and inspecting agency will provide a certified welding inspector (CWI) to perform field inspections and tests, and to report whether tested Work complies with or deviates from requirements.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    c. Ultrasonic Inspection: ASTM E 164.
    d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. 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 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. KCS-type K-series steel joists.
3. K-series steel joist substitutes.
4. Joist accessories.

1.3 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders", Code of Standard Practice."

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."

1.4 ACTION SUBMITTALS

A. Sustainable Design Submittals: Refer to Division 1, Section "Sustainable Design Requirements".

B. Product Data: For each type of joist, accessory, and product.

C. Shop Drawings: Show layout, designation, number, type, location, and spacing of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

1. Indicate locations and details of bearing plates to be embedded in other construction.
2. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Manufacturer certificates.

D. Mill Certificates: For each type of bolt.

E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
2. Assumes responsibility for engineering special joists to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
3. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of joists that are similar to those indicated for this Project in material, design, and extent.

B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1. Welders shall be AWS certified and shall be qualified for welding processes involved and, if pertinent, have undergone recertification.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications".

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

1. Use ASD. Data is 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.

3. Recycled Content: Provide products with a minimum post-consumer recycled content of 60%.

2.2 PRIMERS

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications 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 (unless noted otherwise), of joist type indicated.

1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

D. Provide holes in chord members for connecting and securing other construction to joists.

E. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

G. Do not camber steel roof joists.

H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal and 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.

B. Steel bearing plates with integral anchorages are specified in Division 5.

C. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface unless otherwise indicated.

D. Welding Electrodes: Comply with AWS standards.

E. Galvanizing Repair Paint: ASTM A 780.

F. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 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 (0.025 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing 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

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field connect joists to supporting structure as indicated. Where welding is indicated, 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. 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.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and to perform field tests and inspections and prepare test and inspection reports.

B. Visually inspect field welds according to AWS D1.1.

1. In addition to visual inspection, test field welds according to AWS D1.1 and the following procedures, as applicable:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709.
c. Ultrasonic Testing: ASTM E 164.
d. Radiographic Testing: ASTM E 94.

C. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

D. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists bearing plates, abutting structural steel, and accessories.
   1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
   2. Apply a compatible primer of same type as primer used on adjacent surfaces.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Composite floor deck.
3. Non-composite form deck.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding Certificates: Copies of certificates for welding procedures and personnel.

B. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

C. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and 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."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 ROOF DECK

A. 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 Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G60 zinc coating.
2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 G60 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.

2.4 NON-COMPOSITE FORM DECK

A. Non-Composite Steel Form Deck: Fabricate ribbed-steel sheet non-composite form deck panels to comply with "SDI Specifications and Commentary for Non-Composite Steel Form Deck," in SDI Publication No. 31, the minimum section properties indicated, and the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 80, G60 zinc coating.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.5 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. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. 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.

F. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

J. Shear Connectors: ASTM A108, Grades 1015 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.

K. Galvanizing Repair Paint: ASTM A 780.

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.

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 decking 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 decking.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, 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.

3.3 ROOF DECK INSTALLATION

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter and spacing indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated.

1. Mechanically fasten with self-drilling No. 10 diameter or larger carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints lapped 2 inches minimum.

D. Miscellaneous Roof Deck Accessories: Install finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: As indicated.
2. Weld Spacing: Space and locate welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Butted.

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: Owner will engage a certified welding inspector (CWI) to perform field quality control testing.

B. Field welds will be subject to inspection.

C. CWI will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. 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.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

C. Repair Painting: Wire brush and clean rust spots, weld, and abraded areas on underside of prime paint deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

END OF SECTION 053100

SECTION 054000
COLD-FORMED STEEL FRAMING - STRUCTURAL (CFSF-S)

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members.

E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel.

G. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.03 SUBMITTALS

A. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations and accessories.

B. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate ceiling stud and track layout.
   2. Describe method for securing studs to tracks and for bolted framing connections.
   3. Design data:
      a. Shop drawings signed and sealed by a professional structural engineer licensed in the state of which the project is located.
   4. Calculations for loadings and stresses of specially fabricated framing, signed and sealed by a professional structural engineer licensed in the state of which the project is located.
   5. Details and calculations for factory-made framing connectors, signed and sealed by a professional structural engineer licensed in the state of which the project is located.

D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

E. Product test reports for steel sheet, Power-actuated anchors, mechanical fasteners, vertical deflection clips, and miscellaneous structural clips and accessories.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system 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. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect cold-formed steel framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed steel framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Requirements: Provide completed framing system having the following characteristics:

1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100.
2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
3. Design Loads: As indicated on the drawings.
4. Framing shall be designed to resist design loads with deflections not greater than the followings:
   a. Ceiling framing shall have a vertical deflection not greater than L/240 for total load and L/360 for live loads.
5. Able to tolerate 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 subject to a maximum ambient temperature change of 120 deg F.
6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings with an upward and downward movement of [1] inch.

2.02 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.

1. Stud: 1 5/8 inch flange width; load bearing - 0.0428 in (18 gage) minimum and non-load bearing - 0.0329 inch (20 gage).
2. Track: 1 1/4 inch flange width; thickness to match stud thickness.
3. Galvanized in accordance with ASTM A653/A653M, G60/Z180 coating.

B. Steel Box or Back to Back headers studs formed to C- or Sigma-shaped with unpunched web; with stiffeners, U-shaped track in matching nominal width and compatible height.

C. Steel Single or Double L headers formed to L shapes used to form header beams of web depths indicated.

D. Header: Engineered one-member or two-member assembly, with wide flanges, designed to replace conventional box or nested header framing at openings.

1. Jamb Mounting Clips: Manufacturer's standard.

2. Cripple Stud Clips: Manufacturer's standard.

E. Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G60/Z180 hot dipped galvanized coating.
   1. Base Metal: Structural Steel (SS), Grade 33/230.
   2. Flange width of 1 5/8 inches, with depths as indicated on plans.
   3. Gauge: As required to meet specified performance levels.

F. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gauge, 0.1345 inch, and factory punched holes and slots.
   2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100.
   3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.03 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

C. Welding: Comply with AWS D1.1/D1.1M.

2.04 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.

C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type II - Organic, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF CEILING/BULKHEAD FRAMING

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Place ceiling framing studs at a maximum of 16 inches on center; not more than 2 inches from abutting walls, and connect joists to supports using fastener method.

D. Set ceiling framing parallel and level, with lateral bracing and bridging.

E. Locate joist end bearing directly over load-bearing studs or provide load distributing member to top of stud track.

F. Provide web stiffeners at reaction points.

G. Touch-up field welds and damaged galvanized surfaces with primer.

END OF SECTION 054000

SECTION 054003
CONTINUOUS INSULATION (CI) FRAMING SYSTEM, CLIPPED

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

F. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members.

G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

H. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

I. ASTM F594 - Standard Specification for Stainless Steel Nuts.

J. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric.

K. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.02 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Conduct pre-installation meeting at Project site 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.

B. Coordinate with work of other sections that is to be installed over, or anchored to, the continuous insulation (CI) framing system, including but not limited to structural anchors, claddings and cladding anchors, utilities, insulation, and firestopping.

1.03 DEFINITIONS

A. Clipped Continuous Insulation (CI) Framing System: An engineered “fixing” system of framing designed to support building veneers on metal girts, transmitting all structural loads through insulation to the wall substrate via intermittent, thermally-isolated clips while maintaining required thermal performance of the wall.

1.04 SUBMITTALS

A. Product Data: Provide product data for factory fabricated continuous insulation (CI) framing members and each accessory product.

B. Shop Drawings: Indicate component details, including sizes, depths, and thicknesses of clips, girts, rails, and accessories or items required of related work.

1. Indicate cladding joint layout, with CI framing system clip and girt layout and spacing coordinated for proper anchorage and support.

2. Indicate anchorage details including mechanical fasteners for securing CI framing system to primary structural wall element.
    a. Indicate supplemental framing and reinforcing as required due to structural calculations.
3. Design Data: Include calculations for loadings and stresses of factory fabricated CI framing for project specific claddings and loadings, signed and sealed by a professional structural engineer.

C. Thermal Modeling Report: Provide test data indicating reduction of R-value of continuous insulation due to framing penetrations. Test data shall demonstrate, at minimum, compliance with ANSI/ASHRAE 90.1 U-factor requirement for walls of construction indicated.

D. Test Reports: Provide test reports performed by a qualified testing agency, for structural anchors, mechanical fasteners, framing clips, and accessories.

E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

F. Designer's Qualification Statement.

G. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design CI framing system 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. Installer Qualifications: Company specializing in exterior/envelope wall systems installation, experienced in the erection and installation of CI framing systems with a history of successful in-service use.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory-provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Prior to installation, store materials and components under cover in a dry, clean location.

D. Protect CI framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

1.07 WARRANTY

A. Warranty: Installer's warranty against failures in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion. Failures include structural cracks or punctures, material deterioration, and workmanship.
    1. Warranty Period: Two years beginning at the date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Continuous Insulation (CI) Framing Systems:
    1. Aluminum Systems:
        a. ECO Cladding; Alpha Vci / Hci.
        b. GIP GmbH; VECO-A.
        c. Hilti; FOX VI.
        d. SFS intec Ltd. / NVELOPE Rainscreen Systems Ltd.; NV / NH2.

2. Steel Systems:
   a. GIP GmbH; VECO-G.
   b. Knight Wall Systems; MFI D-Series.
3. Substitutions: See Section 016000 - Product Requirements.

2.02 CONTINUOUS INSULATION (CI) FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Requirements: Provide completed CI framing system, capable of supporting indicated exterior finish cladding(s) in a "rainscreen" design when anchored to indicated structural substrates. System shall consist of thermally isolated brackets supporting vertical girts. Where necessary due to cladding orientation or engineered design, vertical girts shall support horizontal rails. Design shall have the following characteristics:
   1. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
   2. Design Loads: Refer to Structural Drawings for wind and live loads.
   3. Spacing and types of girts and rails shall be as required by cladding manufacturer to support each indicated type of cladding.
      a. Coordinate with cladding manufacturer(s) for dead loads of cladding system(s).
      b. Coordinate with indicated joint layouts to ensure secondary girts are spaced to provide appropriate structural attachment for cladding(s).
   4. Able to tolerate 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. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

C. Thermal Performance: System shall obtain effective R-value or U-factor indicated.
   1. Continuous framing profiles fully penetrating insulation are not allowed. Metal framing shall not thermally bridge exterior and interior except for fasteners.
   2. Framing assembly shall not reduce continuous insulation nominal R-value to less than 90% effective R-value.
   3. Continuous insulation framing system shall be thermally modeled to demonstrate, at minimum, compliance with ANSI/ASHRAE 90.1 maximum U-factor for walls.

D. Flatness: Installed system and components shall be flat within the tolerances allowable by cladding manufacturer; with no noticeable warping, buckling, deflections, or other surface irregularities that distort cladding.

E. Heat Resistance: All components that will come into contact with spray foam insulation shall be capable of exposure to the heat generated by spray foam installation without damage, including plastic washers and thermal spacers. Plastics and resins shall be rated for exposure to temperatures of 300 degrees Fahrenheit or more intermittently without loss of structural capacity or integrity.

F. Ventilation: System design shall allow for movement of air in the cavity behind the cladding, including compartmentalization and/or cross-ventilation for a pressure-equalized system where indicated.

G. Drainage: System design shall allow for drainage of moisture from the cavity behind the cladding.

H. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with Code of Standard Practice.

I. Shop fabricate framing system to the greatest extent possible.

J. Deliver to project site in largest practical sections.

2.03 CONTINUOUS INSULATION FRAMING MATERIALS

A. Steel Framing: Either ASTM A792/A792M aluminum-alloy coated steel or ASTM A1046 zinc-aluminum-magnesium alloy coated steel.

B. Aluminum Framing: ASTM B209/B209M, Alloy 6061-T6 for plate and sheet and ASTM B221, Alloy 6063-T6 for extrusions.

C. Brackets: To suit girts and cladding system loads, and providing for field adjustment of girts to maintain plane of cladding. Provide fixed or floating type as required to accommodate expansion.

D. Girts: As required to suit anchoring of perpendicular rails. Provide either vertical or horizontal girts as required due to indicated orientation of cladding.

1. Perpendicular Rails: Subframing rails mounted to girts, to meet the requirements of cladding manufacturer for support and attachment at cladding ends and joints, and for regular spacing for attachment of claddings.

2.04 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Type 304 stainless-steel or zinc-plated with electrodeposition coating per ASTM B633 or ASTM F1941/F1941M.

B. Anchorage Devices: Drilled expansion bolts or chemical anchors; Alloy Group 1 stainless steel per ASTM F593 for bolts and ASTM F594 for nuts.

2.05 ACCESSORIES

A. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION

A. Install components in accordance with manufacturers' instructions.

B. Attach primary brackets prior to application of spray foam insulation/air barrier. Install brackets true to line with secure connections to primary structural components, at spacing required by load calculations and as indicated on Shop Drawings.

C. After installation of spray foam insulation/air barrier, remove only amount needed for attachment of secondary girts/rails and cladding support anchors. Notify spray foam installer if amount of material removed affects wall's insulating or air/vapor barrier performance, or if touch up is required.

D. Install framing girts/rails plumb, square, and true to line, with securely fastened connections.

1. If cutting is required, cut by sawing or shearing, do not torch cut. Protect adjacent surfaces from sparks.

2. Fasten CI framing members by screw fastening. Locate all mechanical fasteners as indicated on Shop Drawings.

3. Locate screws at slotted holes to allow for expansion and contraction in the CI framing system design.
4. Each girt shall be supported by at least two primary support brackets.
5. Do not bridge building expansion joints with CI framing. Independently frame both sides of joints.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/8 inch.

B. Maximum Variation of any Member from Plane: 1/8 inch, unless otherwise indicated by cladding manufacturer.

3.04 REPAIR AND PROTECTION

A. Touch up shop-applied coatings as required if damaged during handling or installation.

B. After installation of primary support brackets, inspect substrates for damage and repair substrate flashings or membranes as required.

C. Provide fine adjustments to CI framing as required immediately prior to cladding installation to verify that tolerances are maintained. Prepare CI framing in a timely manner to avoid excessive UV exposure to substrate membranes, air barriers, and other materials.

D. Provide final protection of CI framing as required to ensure that CI framing system is without damage or deterioration prior to installation of cladding.

END OF SECTION 054003

SECTION 055000
METAL FABRICATIONS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

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

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

H. ASTM A536 - Standard Specification for Ductile Iron Castings.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

K. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

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

N. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

O. NAAMM MBG 531 - Metal Bar Grating Manual.

P. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

Q. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.02 SUBMITTALS

A. Product Data: Provide product data for factory fabricated products and accessory materials, including the following:
   1. Stair nosings.
   2. Nonslip finishes.
   3. Nonshrink grout.
   4. Shop primer paint products.
      a. Coordinate with Division 9 Painting topcoat manufacturer and provide compatibility certificates from topcoat manufacturer that shop primers are acceptable substrate for specified topcoats.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details

where applicable.

1. Include field measurements, and indicate where field measurements differ from documents.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.03 QUALITY ASSURANCE

A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

B. Field Measurements: Take field measurements prior to fabrication and verify that dimensions and tolerances are acceptable for fabricated products to fit the space. Indicate field measurements on shop drawings.

PART 2 PRODUCTS

2.01 GENERAL

A. Materials, General: Provide metal fabrications and components with finished surfaces that are smooth and flat. Metal fabrications and components shall not have labels, stickers, engraved or rolled manufacturer names, seams, or blemishes that are exposed in the finished work.

2.02 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Slotted Channel Fittings: ASTM A1011/A1011M.

F. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

1. Provide stainless steel fasteners for all exterior construction and for fastening aluminum and stainless steel fabrications.
2. Provide stainless steel fasteners at areas subject to moisture or steam, including mechanical rooms, janitor/custodial rooms with floor sinks, and similar spaces.
3. Provide zinc-plated fasteners for interior construction except where stainless steel is indicated.

G. Bolts, Nuts, and Washers: ASTM A307, Grade A, galvanized to ASTM A153/A153M where connecting galvanized components.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, universal shop primer, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.03 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.04 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. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.05 FABRICATED ITEMS

A. Metal Ladders: Refer to Section 055133 - Metal Ladders.

B. Bollards: Schedule 40 steel pipe, concrete filled, crowned cap, as detailed; nominal 6-inch diameter unless otherwise indicated; prime paint finish.
   1. In lieu of field formed crowned cap, Contractor may at its option provide precast, symmetrically domed caps.

C. Removable, Decorative Bollards: Type 304 stainless steel with #4 satin finish; 6 inch diameter, 48 inch high with dome style top.
   1. Provide with 12 inch deep embedment sleeve with flush flange at grade level and with hinged cover. Bollard shall be padlockable for securement.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and masonry; prime paint finish.

E. Lintels: As detailed; prime paint finish.

F. Door Frames for Overhead Door Openings and Wall Openings: Channel or bent plate sections; prime paint finish.

G. Elevator Hoist Beams: Beam sections; prime paint finish.

H. Elevator Sills: Provide angle shapes for slab edge locations and elevator sill supports; size in coordination with elevator manufacturer's requirements.

I. Slotted Channel Framing: Fabricate channels and fittings from ASTM A1011/A1011M, Grade 33 structural steel complying with the referenced standards; with factory-applied, rust-inhibiting thermoset acrylic enamel finish.
   1. Provide 1-5/8 inch by 1-5/8 inch channel unless otherwise indicated.

J. Bar Gratings: NAAMM MBG 531, welded or pressure-locked galvanized steel type. For all gratings, unless otherwise indicated, provide manufacturer's standard galvanized cross rods or bars spaced at 4 inches o.c.
   1. Elevator Sump Grating: Removable; type W-19-4 or P-19-4 per MBG 531; minimum 1-inch high by 1/8-inch thick galvanized steel bearing bars, spaced approximately 1-3/16-inch o.c; with cross bars at 4 inches o.c.
   2. Provide welded frames for bar gratings, fabricated of galvanized steel shapes, with integral anchors/lugs for casting into concrete.

K. Miscellaneous Steel Shapes: Provide steel shapes for miscellaneous applications indicated on drawings, including but not limited to, reinforcing steel shapes at low partitions/knee walls and concrete slab edge angles.

2.06 FACTORY FABRICATED STAIR NOSINGS

A. Factory Fabricated Stair Nosings: For casting into concrete stairs.
   1. Materials: Extruded aluminum, alloy type 6063-T5, mill finish.

a. Tread Abrasive Filler: Aluminum-oxide epoxy-bonded to tread base.
b. Tread Type: Ribbed bar.
c. Nosing Types: Angled long nose for sloped stairs.
d. Color: Black.
e. Depth: 3 inches nominal.

2. Manufacturers:
a. Balco, Inc.; R-315PC.
b. Nystrom, Inc; Ribbed Bar Nosing with EcoTread (STSB-ECO).
c. Wooster Products, Inc.; Type 231BF.
d. Substitutions: See Section 016000 - Product Requirements.

2.07 ENCLOSURE GATES

A. Enclosure Gates: Fabricate gate assembly, including steel gate posts, gate leaves, infill panels, and hardware, in configuration indicated. Galvanize all steel components.
1. Gate Posts: Provide Schedule 80 steel pipe gate posts, unless indicated otherwise. Close tops of posts with cap plates, welded and ground smooth.
2. Gate Framing: Provide 3-inch by 3-inch steel angle or bent plate for perimeter and intermediate framing of gates. Fabricate framing by welding; grind joints smooth.
3. Provide all necessary bracing and reinforcement as required for square, level, and flush operable gates.
4. Provide all fasteners, accessories, and hardware for a complete and operable gate assembly, unless indicated otherwise.
5. Infill Panels: Provide prefabricated galvanized steel vision screen assembly for 100% visual screening. Infill panels may be secured to gate framing by welding or by mechanical attachments. If using fasteners, fasteners shall be concealed along sides of framing, with smooth exposed heads. Do not fasten to front faces of frame.
a. Products:
1) Ametco Manufacturing Corporation; Shadow 100.
2) Barnett Bates; Orsogril Talia 100.
3) Substitutions: See Section 016000 - Product Requirements.
6. Hardware: Provide the following:
a. Barrel Hinges: Exterior grade, weld-on type with grease fitting, of mild steel with stainless steel pin. Size to suit weight of gate, but rated not less than 600 pounds per hinge. Provide a minimum of two per gate leaf, unless indicated otherwise.
b. Pulls: Bent, 1/4-inch by 1-inch galvanized steel bar stock, welded to frame. Minimum 6-inch high by 2-inch deep pull. Provide one at each gate leaf, vertically mounted.
c. Staple and Hasp: To suit a standard padlock. Padlock is NIC.
d. Cane Bolts: Minimum 30 inch length, with attachment hangers/brackets that hold bolts in retracted position, and with a weld pin positioned to prevent cane bolt from being accidentally removed from lower bracket. Provide one per gate leaf. Provide receiver cups for each gate leaf in both the closed and 90 degree open positions, to allow for gates to be held open. Fill spaces around receiver cups with non-shrink grout.

2.08 FINISHES - STEEL

A. Prime paint steel items.
1. Exceptions: Galvanize and do not prime items to be embedded in concrete and items to be embedded in masonry. Do not prime items to be embedded in sprayed fireproofing.

B. Prepare interior items to be primed in accordance with SSPC-SP3 Power Tool Cleaning.

C. Prepare exterior items to be primed, and interior items to receive specialty protective coating such as zinc-rich primer, in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.

D. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

E. Prime Painting: One coat.

F. Galvanizing: Galvanize after fabrication to ASTM A123/A123M requirements.

G. Slotted Channel Framing: ASTM A1011/A1011M Grade 33; coated with manufacturer's standard rust-inhibitive acrylic enamel.

2.09 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I natural anodized.

B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

C. Apply corrosion protection coating to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.10 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

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.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

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. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

F. Installation of Nosings: Center nosings on stair width with 4 inch inset at each end. Embed nosings in wet concrete, flush to top of each tread and aligned to front edge of each riser. Coordinate with concrete installer to tool concrete around the nosings for a smooth, clean

finish. Remove protective masking tape after concrete has set and cured and clean any concrete residue.

G. Installation of Bollards: Anchor bollards in concrete footings to a minimum depth of 36 inches with 6 inches of concrete below bottom of bollards. Fill bollards with concrete.
   1. At Contractor's option, provide either precast caps secured to wet concrete fill, or field-mound wet concrete fill to form a rounded cap.

H. Installation of Gates: Anchor gate posts in concrete footings, to a minimum depth of 36 inches with 6 inches of concrete below bottom of posts.
   1. Install gate leaf assemblies to smoothly operate without sagging or binding.
   2. Install all hardware for proper operation. Drill cores into concrete apron and install cane bolt receiver sleeves into cores flush with grade. Fill spaces around gate posts and cane bolt receivers with non-shrink grout.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 055000

SECTION 055100
METAL STAIRS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

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

L. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

N. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel.

P. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

1.02 SUBMITTALS

A. Product Data: Provide manufacturer's product data for metal stairs.
   1. Provide data for shop primer and for nonshrink grout.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Design Data: Include delegated-design shop drawings, including structural calculations and details for loadings and stresses, and anchors and connections.
3. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Designer's Qualification Statement.

1.03 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

C. Indoor Emissions: For each type of paint and coating, comply with the emissions requirements of California Department of Public Health (CDPH); "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers."

D. VOC Content: For each type of paint and coating, comply with VOC content restrictions as required by 40 CFR 59, Subpart D (EPA's "National Volatile Organic Compound Emission Standards for Architectural Coatings").

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
a. Head Clearance: Maintain a minimum of 80 inches head clearance along all paths of travel (the "walk line") as measured above stair noses or finished walking surfaces.
2. Structural Design: Provide complete stair and railing assemblies that comply with the following:
a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/360 of span.
1) Deflection shall not exceed 1/720 of span where brittle finish materials such as stone, ceramic tile, or terrazzo are indicated.
b. Railing Assemblies: Refer to Division 5 "Pipe and Tube Railings."
3. Dimensions: As indicated on drawings.
4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels, per NAAMM AMP 510 "Metal Stairs Manual":
1. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.

a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
b. Welds Exposed to View: Ground smooth and flush.
c. Mechanical Joints: Butted tight, flush, and hairline.
d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
e. Exposed Edges and Corners: Eased to small uniform radius.
f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Commercial, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
1. Concrete Depth: 1-1/2 inches, minimum.
2. Tread Pan Material: Steel sheet.
3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch minimum.
4. Concrete Reinforcement: Welded wire mesh.
5. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.
1. Nosing Depth: Not more than 1-1/2 inch overhang.
2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Rolled steel channels.
1. Stringer Depth: 10 inches.
2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Railings: Steel pipe railings.

2.03 HANDRAILS AND GUARDS

A. Handrails and Guards: See Section 055213.

2.04 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 with G40/Z120 coating.

G. Reinforced Concrete Fill: Refer to Section 033000.

2.05 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15 or MPI #79, compatible with topcoat indicated in Division 9 Section "Painting," and comply with VOC limitations of authorities having jurisdiction.
   1. At exterior and galvanized surfaces, provide zinc-rich primer; SSPC-Paint 20 or MPI #20, compatible with topcoat, and VOC-compliant.

D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 or MPI #20, compatible with topcoat, and comply with VOC limitations of authorities having jurisdiction.

E. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Grout: Comply with ASTM C1107/C1107M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION 055100

SECTION 055133
METAL LADDERS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements.

B. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices.

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

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

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

K. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel.

M. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

N. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

O. SSPC-SP 2 - Hand Tool Cleaning.

1.02 SUBMITTALS

A. 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.

B. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

C. Designer's Qualification Statement.

1.03 QUALITY ASSURANCE

A. Design ladders 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. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

F. Bolts, Nuts, and Washers: ASTM A307, galvanized to ASTM A153/A153M where connecting galvanized components.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. 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. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED LADDERS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; galvanized finish. Provide mounting brackets at top and bottom of ladder and at no more than 60 inches o.c. For elevator pit ladders, comply with requirements of ASME A17.1.
   1. Side Rails: 5/8 by 2-1/2 inch members spaced at 18 inches.
   2. Rungs: 3/4 inch diameter solid round bar spaced 12 inches vertically on center.
      a. Cover top of each rung with a non-slip coating or with a premanufactured nonslip cover.
      b. Space rungs 7 inches from wall surface.

2.04 FINISHES - STEEL

A. Prepare surfaces to be primed in accordance with SSPC-SP2.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Masonry Walls: Confirm that masonry wall assemblies provide adequate structural support for anticipated ladder loads.

C. Metal Framed Walls: Confirm that blocking and reinforcing have been installed in appropriate locations in the wall assembly to provide adequate structural support for anticipated ladder loads.

3.02 PREPARATION

A. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

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 shop 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.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 055133

SECTION 055213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

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

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

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

E. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

G. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

1.02 SUBMITTALS

A. Product Data: Provide manufacturer's product data for pipe and tube railings.

B. Sustainability Submittals: Refer to Division 1 Section "Sustainable Design Requirements."

C. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
2. Design Data: Include delegated-design shop drawings, including structural calculations and details for loadings and stresses, and anchors and connections.
3. Include the design engineer's seal and signature on each sheet of shop drawings.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous 12 months.

E. Designer's Qualification Statement.

1.03 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.

C. Indoor Emissions: For each type of paint and coating, comply with the emissions requirements of California Department of Public Health (CDPH); "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers."

D. VOC Content: For each type of paint and coating, comply with VOC content restrictions as required by 40 CFR 59, Subpart D (EPA's "National Volatile Organic Compound Emission

Standards for Architectural Coatings").

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 50 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

F. Provide brackets, flanges, anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

1. For anchorage to concrete or solid masonry, provide brackets anchored with drilled in expansion shields and hanger or lag bolts.
2. For anchorage to hollow masonry, provide brackets anchored with toggle bolts.
3. For anchorage to stud walls, provide brackets anchored with hanger or lag bolts to fire-retardant-treated wood blocking, or with toggle bolts to steel reinforcing backing plates.
    a. Coordinate anchorage locations with Division 6 "Rough Carpentry" and / or Division 9 "Cold-Formed Steel Framing - Non-Structural (CFSF-NS)" to provide blocking or backing plates in framed walls, as applicable.

G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, galvanized finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws.

E. Galvanizing: In accordance with requirements of ASTM A123/A123M.

F. Shop and Touch-Up Primer: SSPC-Paint 15 or MPI #79, compatible with topcoat indicated in Division 9 Section "Painting," complying with VOC limitations of authorities having jurisdiction.

1. At exterior and galvanized surfaces, provide zinc-rich primer; SSPC-Paint 20 or MPI #20, compatible with topcoat, and VOC-compliant.

G. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Grout: Comply with ASTM C1107/C1107M.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 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.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 055213

SECTION 057000
DECORATIVE METAL RAILING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. ADA Standards - 2010 ADA Standards for Accessible Design.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

D. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

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

J. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

K. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel.

M. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Schedule and conduct a preinstallation meeting at the Project Site.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.

B. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

C. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.

D. Manufacturer's qualification statement.

E. Welders' qualification statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing decorative railing systems and acceptable to manufacturer.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.6/D1.6M no more than 12 months before start of scheduled welding work.

1.05 MOCK-UPS

A. Provide mock-up of railing system, approximately 10 feet long, illustrating each type of material, cladding, and finish.

B. See Section 014000 - Quality Requirements for additional requirements.

C. Locate where directed by Architect.

D. Approved mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory-provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.

D. Prior to installation, store materials and components under cover in a dry location.

1.07 FIELD CONDITIONS

A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F and maximum 95 degrees F.

B. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after railing installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Metal Railings - Aluminum with Stainless Steel Cable Infill:
   1. Global Glass Railings.
   2. Morse Industries.
   3. Stainless Fabricators, Inc.
   4. ViewRail.
   5. Viva Railings, LLC.
   6. Substitutions: See Section 016000 - Product Requirements.

2.02 RAILING SYSTEMS

A. Railing Systems - General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.
   1. Performance Requirements: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.

a. Lateral Force: 75 lb minimum, at any point, when tested in accordance with ASTM E935.
b. Distributed Load: 50 lb/ft 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, minimum.
d. Concentrated Load: 200 lbs minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.

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 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: Engineered, post-supported railing system with cable infill.
1. Configuration: Guardrail with separate handrail.
   a. Height: 42 inch minimum height to top of guardrail.
2. Posts: 2 inch by 2 inch square structural aluminum tube posts with minimum 0.150-inch wall thickness.
3. Top Guardrail: 2 inch by 1 inch rectangular aluminum tube.
4. Handrail: Round, stainless steel, 1-1/2 inch diameter.
5. Decorative Flanges for Embedded Posts: Square, collared cover plate without screw holes.
6. Provide manufacturer's standard brackets for mounting handrail to vertical posts.
7. Fasteners: Manufacturer's standard; fasteners shall be concealed to greatest extend possible.
8. Infill at Cable Railings: Stainless steel cable.
   a. Material: ASTM A666, Type 304 or Type 316; 3/16-inch diameter.
   b. Mounting: Mechanically attached to frame.

2.03 MATERIALS

A. Aluminum Components: ASTM B221 or ASTM B221M.
1. High-Performance Organic Finish: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

B. Stainless Steel Components:
1. ASTM A666, Type 304.
2. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch minimum metal thickness, 1-1/2 inch diameter.
3. Stainless Steel Finish: No. 4 Bright Polished finish.

2.04 ACCESSORIES

A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

B. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete for bolt anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry for bolt anchors.
   3. For anchorage to stud walls, provide backing plates for bolt anchors.
   4. Exposed Fasteners: No exposed bolts or screws.

C. Carbon Steel Bolts and Nuts: ASTM A307.

D. Hydraulic Expansion Cement: ASTM C1107/C1107M.

E. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 0.015 inch 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. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.

B. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections, and abraded areas.
   4. Touch up shop primer and factory-applied finishes.
   5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.05 FIELD QUALITY CONTROL

A. Field Services: Provide the services of the manufacturer for field observation of installation of railings.

3.06 CLEANING

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

3.07 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.

1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION 057000

SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

C. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.

D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

E. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

G. AWPA U1 - Use Category System: User Specification for Treated Wood.

H. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2.

I. EPA (TSCA); Title VI - Toxic Substances Control Act, Title VI: Formaldehyde Standards for Composite Wood Products.

J. PS 1 - Structural Plywood.

K. PS 20 - American Softwood Lumber Standard.

L. SCAQMD 1168 - Adhesive and Sealant Applications.

1.02 SUBMITTALS

A. Product Data: Provide technical data for fire-retardant materials, wood preservative materials, and include certification that materials and treatment comply with manufacturer's requirements.

1. Evaluation Reports: Provide ICC-ES evaluation reports for each applicable item below:
    a. Preservative-treated lumber.
    b. Fire-retardant-treated lumber.
    c. Each type of engineered wood.
    d. Shear panels.
    e. Each type of power- or powder-actuated fastener and expansion anchor.
    f. Structural wood connectors (framing anchors).

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications (for Fire-Retardant Treatments): Independent firm specializing in performing testing of treatments of type specified in this section, and performing periodic inspections to ensure that the material receiving the classification marking matches the tested material; and approved by local authority having jurisdiction.

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. Grading Agencies: 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.
      a. Northeastern Lumber Manufacturer's Association (NELMA) - Spruce-Pine-Fir.
      b. Southern Pine Inspection Bureau (SPIB) - Southern Pine.
      c. West Coast Lumber Inspection Bureau (WCLIB) - Douglas Fir, Hem Fir, Spruce-Pine-Fir-South.
      d. Western Wood Products Association (WWPA) - Douglas Fir, Hem Fir; Spruce-Pine-Fir-South.
      e. National Lumber Grades Authority (NLGA) - Douglas Fir-North, Hem Fir-North, Spruce-Pine-Fir.
   2. Provide lumber stamped with grade mark of responsible grading agency, unless otherwise indicated.
      a. Place grade stamp on unexposed surface of lumber specified to be exposed with natural or stained finish, or omit grade stamp and submit documentation from grading agency certifying grade compliance.
   3. Species and Grade:
      a. Species and grade is indicated on Structural Drawings for studs, joists, rafters, beams, columns, ceiling joists, and other structural components, as applicable.
      b. For miscellaneous lumber including non-structural miscellaneous framing, blocking, nailers, grounds, and furring, provide No. 2 or Standard grade.
      c. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
   4. Moisture Content: S-dry or MC19 (19% or less). Applies to lumber for 2-inch nominal thickness and less.

B. Composite Wood: Any composite wood materials installed inside the weatherproofing system shall meet either EPA (TSCA); Title VI for ultra-low-emitting formaldehyde or no added formaldehyde (ULEF / NAUF).

2.02 WOOD CONSTRUCTION PANELS

A. Roof Sheathing (Parapet, Vertical): Exposure 1, veneer faced FRT plywood sheathing. OSB is not acceptable.
   1. Thickness: Minimum 5/8 inch.
   2. Screws for fastening plywood sheathing over rigid insulation at parapets:
      a. For Steel Framing: Provide #10 SIP low profile flat head or pancake head screws intended for wood-to-metal connections, at spacing indicated.
         1) Pullout Capacity: 108 lb minimum in 43 mil (18 gauge) steel.
      b. For Masonry Backup: 1/4-inch diameter, low-profile flat head type concrete screw anchors at 3 inches from each panel edge, and at spacing indicated. Length to suit embedment into CMU of 1-1/4 inches, minimum.
         1) Pullout Capacity: 100 lb minimum at 1 inch embedment in face shell of hollow CMU.

B. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, 1/2 inch.
   1. At Assemblies Indicated with Fire-Rating: Use 5/8 inch Type X, required by indicated tested assembly.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Edges: Square.
   4. Products:
      a. CertainTeed Corporation; GlasRoc Brand.
      b. Georgia-Pacific Gypsum; DensGlass Sheathing.
      c. National Gypsum Company; Gold Bond eXP Sheathing.
      d. USG Corporation; Securock Brand Glass-Mat Sheathing Regular 1/2 in.
      e. Substitutions: See Section 016000 - Product Requirements.

C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 25 or less, when tested in accordance with ASTM E84 (Class A - UL FR-S).

2.03 ACOUSTIC SUBFLOORING ASSEMBLY

A. Cellulose Based Fiber Board Subflooring: ASTM C 209 sound-deadening board composed of recycled paper and wood fibers in a binding medium. Provide 5/8-inch thick units unless indicated otherwise.
   1. Density: Not less than 26 pcf per ASTM C 209.
   2. Tensile Strength: Not less than 450 psi per ASTM C 209.
   3. Hardness: 230 lbs when tested in accordance with ASTM D1037.
   4. Water Absorption by Volume: 5% maximum in a 2-hour immersion.
   5. Expansion Due to Humidity: 0.25% at 50 to 90% relative humidity per ASTM C 209
   6. NRC: 0.20.
   7. Flame Spread and Smoke Developed: 200 and 400 (Class C) per ASTM E 84.

B. Acoustic Underlayment: Acoustic underlayment material designed to acoustically decouple flooring from subflooring.
   1. Products:
      a. Acoustical Surfaces, Inc.; Acoustik.
      b. All Noise Control; Footfall.
      c. KN Rubber; QuietDown.
      d. Sound Seal; Sound Shark.
   2. Material: Acoustic recycled rubber sheet.
   3. Thickness: 1/4 inch.
   4. Flame Spread and Smoke Developed: Maximum 84 and 400, per ASTM E 84.
   5. Method of Installation: Adhesive; as recommended by manufacturer.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Provide hot-dipped galvanized steel complying with ASTM A 153 or stainless steel at exterior, high humidity, and preservative-treated wood locations.
      a. Fasteners at interior FRT shall be per FRT treatment manufacturer's recommendations.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

3. Anchors: Toggle bolt type for anchorage to hollow masonry.
4. Screws/Anchors for Fastening Top-of-Parapet Blocking & Nailers and for Back-of-Parapet Plywood Sheathing over Rigid Insulation:
    a. For CFSF-S Metal Framed Parapets: Provide #10 SIP low profile flat head screws intended for wood-to-metal connections, at spacing indicated. Pullout capacity of 108 lb minimum in 43 mil (18 gauge) steel.
    b. For CMU Parapets: Provide 1/4-inch diameter low-profile flat head type concrete screw anchors, at spacing indicated. Length to suit embedment into CMU of 1-1/4 inches minimum. Pullout capacity of 100 lb minimum at 1 inch embedment in face shell of hollow CMU.

B. Flexible Flashing/Separation Material: Barrier sheet fabricated of polyethylene backed rubberized asphalt or butyl rubber sheet; not less than 25 mil overall thickness.

C. General Purpose Construction Adhesives: Comply with ASTM C557 or ASTM D3498.
1. Adhesives: Adhesives field-applied inside the weatherproofing system shall be tested and determined compliant in accordance with CAL (CDPH SM) AND shall meet the chemical content requirements of SCAQMD 1168.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
1. Fire-Retardant Treated Wood: Provide FRT lumber and plywood stamped with name and mark of qualified testing agency, fire-retardant treatment product and manufacturer, wood species and drying method, testing standards, and flame spread and smoke development indices.
    a. For exterior FRT and FRT that will be exposed to moisture, include accelerated weathering test language, with the words "No increase in the listed classification when subjected to Standard Rain Test ASTM D2898".
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 and maximum smoke developed index of 450, when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
    b. Treat exterior rough carpentry items associated with roof construction, concealed blocking, and as indicated on Drawings.
    c. Do not use treated wood in direct contact with the ground.
2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 and maximum smoke developed index of 450, when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

b. Treat interior concealed blocking, plywood backing panels, and other rough carpentry items as indicated.
c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

3. Strength Adjustments (Structural Panels/Plywood): Test FRT structural panels/plywood per ASTM D 5516 and develop strength adjustment factors per ASTM D 6305.
4. Strength Adjustments (Lumber): Test FRT lumber per ASTM D 5664 and develop strength adjustment factors per ASTM D 6841.

C. Preservative Treatment:
1. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA). Do not use lumber or plywood treated with inorganic boron (SBX) for applications exposed to water, ground/soil contact, or interior floor slabs/concrete. Comply with additional treatment restrictions as required by local authorities having jurisdiction.
2. Preservative Pressure Treatment of Lumber & Plywood Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
a. Use Category UC2 is acceptable for interior lumber and plywood above grade (not in contact with floor slab).
b. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
c. Treat lumber exposed to weather.
d. Treat lumber in contact with roofing, flashing, or waterproofing.
e. Treat lumber in contact with masonry or concrete.
f. Treat lumber less than 18 inches above grade, and lumber located directly against below-grade exterior walls.
g. Treat lumber in other locations as indicated.
3. Preservative Pressure Treatment of Lumber in Contact with Ground/Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.
a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 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.

3.03 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 metal-framed walls, provide continuous FRT blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In metal-framed walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of

support is explicitly indicated.

D. Where PPT blocking is indicated to be installed directly adjacent to metal decking or other galvanized metals, provide flexible flashing/separation material as a continuous barrier to prevent direct contact between materials.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Top-of-Parapet Blocking and Nailers: Secure wood blocking and plywood nailers to prepared substrate using mechanical fasteners to attain loading design requirements. Adhesive anchorage of wood nailers & blocking is not acceptable. Coordinate with installation of continuous insulation and air barrier membrane/roof membrane materials.

1. Installation at CMU Parapets: Secure parapet blocking and nailers to CMU with screw anchors in two rows, staggered, at 32 inches on center; except within 10 feet of building corners provide two staggered rows at 24 inches on center. Provide fasteners sized for embedment length into CMU of 1-1/4 inch, minimum. Install screws in accordance with manufacturer's instructions, with screw heads flush with uppermost surface off indicated blocking or plywood nailer.
2. Installation at CFSF-S Metal Framed Parapets: Secure blocking and nailers to metal framing at #10 SIP screws in 2 rows at 16 inches on center; except within 10 feet of building corners provide 2 rows at 12 inches on center. Provide attachment in accordance with APA Form No. T625C, Table 1; for 3/4 inch plywood thickness, wall stud spacing, and wind exposure category indicated.

C. Back-of-Parapet Sheathing Over Rigid Insulation: Secure plywood sheathing over XPS / XEPS insulation to prepared substrate using mechanical fasteners to attain loading design requirements. Adhesive anchorage is not acceptable. Coordinate with installation of continuous insulation and air barrier membrane/roof membrane materials.

1. Stagger vertical butt joints of plywood sheathing.
2. Installation at CMU Parapets: Secure sheathing over board insulation with screw anchors, embedment length of at least 1-1/4 inches into CMU substrate. Fastener spacing shall be 16 inches horizontally and 8 inches vertically.
3. Installation at CFSF-S Metal Framed Parapets: Secure sheathing over board insulation anchored directly to CFSF-S framing with #10 SIP screws. Fastener spacing shall be 16 inches horizontally and 8 inches vertically; verify with spacing of installed CFSF locations in field.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws as indicated.

1. Screw panels to cold-formed steel framing.
2. Space panels 1/8-inch apart.

B. Communications and Electrical Room Mounting Boards: Secure with screws, to furring or to framing as applicable, with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

3.06 CLEANING

A. Waste Disposal: Refer to Section 017419 - 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 061000

SECTION 064100
ARCHITECTURAL WOODWORK AND CASEWORK

PART 1 GENERAL

1.01 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches 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 above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.

C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches above finished floor.

1.02 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard.

B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.

C. ANSI A208.1 - American National Standard for Particleboard.

D. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

G. AWI (QCP) - Quality Certification Program.

H. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

I. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

J. BHMA A156.9 - Cabinet Hardware.

K. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2.

L. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.

M. EPA (TSCA); Title VI - Toxic Substances Control Act, Title VI: Formaldehyde Standards for Composite Wood Products.

N. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

O. ISFA 2-01 - Classification and Standards for Solid Surfacing Material.

P. NEMA LD 3 - High-Pressure Decorative Laminates.

Q. SCAQMD 1113 - Architectural Coatings.

R. SCAQMD 1168 - Adhesive and Sealant Applications.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. Product Data: Component dimensions, configurations, construction details, joint details, attachments.
   1. Include product data for each type of hardware and accessory.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Include field measurements, and indicate where field measurements differ from documents.

C. Selection Samples: Submit manufacturer's color charts indicating full range of available colors, for each product requiring color selection.

D. Verification Samples: Submit physical samples, manufacturer's standard size, for each specified finish and color of the following materials:
   1. For each type of architectural woodwork profile and paneling, minimum 8 inches square or 8 linear inches in length, illustrating proposed shapes, sizes, and finishes of panels, moldings, and other profiles
   2. For each solid wood or wood veneered product indicated to receive transparent finish, provide at least three samples illustrating standard range of wood grain, stain color, and sheen, for selected color.
   3. Plastic laminate.
   4. Solid surface.
   5. PVC edge banding.

E. Fabricator Qualifications: Include evidence of accreditation with quality control program.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with experience on Projects of similar size and scope.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   2. Single Source Responsibility: Provide and install this work from single fabricator.
      a. It is acceptable to subcontract portions of the work to a separate specialty subcontractor (for example, pre-fabricated plastic-laminate-faced casework); however, each fabricator shall be independently accredited; submit accreditation for each fabricator. The primary woodwork contractor shall be responsible for ensuring the work of all Division 06 sections is well coordinated and properly fabricated and installed.

B. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
      a. This AWI (QCP) project is registered as project number [TBD].
   2. Provide for third-party AWI final inspection of fabricated architectural casework (prior to delivery). AWI program of self-certification in lieu of third-party inspection is not acceptable.
   3. Provide for third-party AWI final inspection of field-installed woodwork (after installation). AWI program of self-certification in lieu of third-party inspection is not acceptable.

4. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
5. Provide designated labels on shop drawings as required by certification program.
6. Provide designated labels on installed products as required by certification program.
7. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
8. Replace, repair, or rework all work for which certification is refused.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 2 of the Architectural Woodwork Standards: "Care & Storage."

B. Deliver woodwork after finishes are complete, including painting, and HVAC is operating at occupancy conditions in all spaces where woodwork will be installed.

C. Store in an environmentally controlled location. Protect units from moisture damage.

1.07 FIELD CONDITIONS

A. During and after installation of woodwork, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84, unless otherwise indicated for specific products.

C. All countertop surfaces shall be NSF approved for food contact.

D. Accessibility Requirements: Fabricate and install woodwork and casework in compliance with ICC/ANSI A117.1 and with ADA Standards for Accessible Design.

E. Low-Emitting Materials:
   1. Composite Wood: Any composite wood materials installed inside the weatherproofing system shall meet either EPA (TSCA); Title VI for ultra-low-emitting formaldehyde or no added formaldehyde (ULEF / NAUF).
   2. Paints and Coatings: Paints and coatings field-applied inside the weatherproofing system shall be tested and determined compliant in accordance with CAL (CDPH SM) AND shall meet applicable VOC limits of CARB (SCM) or SCAQMD 1113.
   3. Adhesives and Sealants: Adhesives and sealants field-applied inside the weatherproofing system shall be tested and determined compliant in accordance with CAL (CDPH SM) AND shall meet the chemical content requirements of SCAQMD 1168.

2.02 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Plastic-Laminate-Clad Cabinets: Custom grade, except as modified below. 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: Reveal 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, and with following front-to-back dimensions:
   a. Base Cabinets: 24 inches.
   b. Tall Cabinets: 24 inches.
   c. Wall Cabinets: 12-1/2 inches. (Minimum clear interior depth shall be 11 inches)
3. Drawer Construction: Provide AWI premium grade for drawer box construction.
4. Base Construction: Provide adjustable levelers for all base cabinets to facilitate load transfer to the floor, isolate cabinet ends from the floor, and permit leveling.
   a. Provide one of the following two types of base construction:
      1) Separate Sub-Base: Cabinet sub-base shall be separate and continuous (no cabinet body sides-to-floor), exterior grade plywood with concealed fastening to cabinet bottom. Sub-base shall be ladder-type construction of individual front, back, and intermediates, to form a secure and level platform to which cabinets attach. Recess sub-base at exposed cabinet end panels 1/4 inch from face of finished end, for flush installation of finished base material by other trades.
      2) Integral Base: Provide end panels, cabinet bottoms, and horizontal toe kick members integrally joined together for structural strength. Adjustable levelers shall be provided at each corner for each cabinet.
   b. Toe Kick: Toe kick shall be nominal 4 inch height. Reduce as necessary via field modification due to construction tolerances and concrete slab levelness to maintain maximum height dimensions indicated.
5. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
   a. Finish: Matte or suede, gloss rating of 5 to 20.
   b. Surface Color and Pattern: To be selected by Architect from manufacturer's full range.
   c. Exposed Interior Surfaces: Thermally fused laminate (melamine) is acceptable only at drawer boxes. Provide HPDL, type VGS or CLS, at semi-exposed interiors of cabinets (cabinets with doors). Provide type VGS for exposed interior horizontal shelving surfaces and interiors of open cabinets (no doors).
   d. Apply undecorated laminate backing sheet to concealed reverse side of plastic laminate finished surfaces.
   e. Wood Grain Pattern: If wood grain is indicated or selected for plastic laminate color/pattern, provide sequence matched finish across each elevation. Grain shall run vertically across all doors, drawers, fronts, and false fronts; mismatched grain direction is not allowed.

C. ADA Sink Cabinets: Fabricate a panel of 3/4-inch moisture resistant core material and veneer/cladding material to match adjacent cabinets. Panel shall be removable for service access to undercounter plumbing. Provide with Z-clip attachment system for concealed fastening and with a steel cable retainer, minimum 4 feet long, so that panel can be set aside for service access. Fasten Z-clips and steel cable retainer to panel and to substrate with tamper-resistant fasteners.
   1. Provide an undercounter vertical "apron" piece at front of ADA sink locations as indicated, flush to fronts of adjacent cabinets and finished to match.

2.03 WOOD-BASED COMPONENTS

A. Low-Emitting Materials: Provide composite wood products that meet the requirements of EPA (TSCA); Title VI for formaldehyde emissions.

B. Core Material for Cabinets: ANSI A208.1, Grade M-2 particleboard.

1. At Contractor's option, cabinet backs may be fabricated of ANSI A208.2, Grade MD fiberboard.

C. Core Material for Countertops: Manufacturer's standard ANSI A208.1, Grade M-2 particleboard, or ANSI A208.2, Grade MD fiberboard.
   1. At countertops containing sinks, provide core material meeting ANSI MR10 for moisture resistance. Available Products:
      a. Arauco North America; Duraflake VESTA Moisture Resistant ULEF.
      b. Collins Pine; FreeForm.
      c. Georgia-Pacific; Ultrastock MR MDF.
      d. Roseburg Forest Products; SkyBlend MR-10.

2.04 PANEL CORE MATERIALS

A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.

B. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.

2.05 THERMALLY FUSED LAMINATE PANELS

A. Thermally Fused Laminate (TFL): Melamine- or polyester-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
   1. Test in accordance with NEMA LD 3 Section 3.
   2. Panel Core Substrate: Particleboard.
   3. Color: White.

2.06 LAMINATE MATERIALS

A. Manufacturers:
   1. Formica Corporation; High Pressure Laminate.
   2. Panolam Industries International, Inc; Nevamar Standard HPL.
   3. Panolam Industries International, Inc; Pionite Standard HPL.
   4. Wilsonart LLC; High Pressure Laminate (HPL).

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

C. Color and Pattern: To be selected by Architect from Manufacturer's full range (standard and premium colors) in standard textured finish (textured gloss, fine textured, or suede finish). High gloss, heavy textured, metallic, or other special surface products (abrasion-resistant, chemical-resistant) will not be required for use in this project.

D. Provide specific types as follows:
   1. Horizontal Countertop Surfaces: HGS, 0.048 inch (1.2 mm) nominal thickness.
   2. Vertical Surfaces and Non-Countertop Horizontal Surfaces: VGS, 0.028 inch (0.7 mm) nominal thickness.
   3. Cabinet Liner: CLS, 0.020 inch (0.5 mm) nominal thickness.
   4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.07 SOLID SURFACING MATERIAL

A. Solid Surfacing Material: ISFA 2-01.
   1. Products:

a. Avonite Surfaces, a Brand of Aristech Surfaces, LLC; Avonite.
b. E. I. du Pont de Nemours and Company; Corian.
c. Formica Group; Solid Surfacing.
d. Hanwha L&C; Hanex. (Basis of Design)
e. LG Hausys America; HI-MACS.
f. Lotte Advanced Materials Co. Ltd.; Staron.
g. US Surface Warehouse; LivingStone.
h. Wilsonart LLC; Solid Surface.

2. Thickness: 1/2-inch.
3. Type: Standard Type.
4. Color and Pattern: To be selected by Architect from manufacturer's full range.

2.08 COUNTERTOPS

A. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade and with manufacturer's requirements.

B. Solid Surfacing Countertops and Window Stools: Solid surfacing sheet or plastic resin casting over structural substrate/core material.
1. 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.
2. Core: Fabricate solid surface countertop core of manufacturer's recommended moisture-resistant MDF. Provide continuous structural substrate at unsupported/overhang conditions; ladder construction acceptable over cabinets. Build up core material for total countertop thickness indicated.
3. Fabricate in accordance with manufacturer's standard requirements, and in one piece to the greatest extent possible.
a. Shop-fabricate cutouts and holes in solid surface for plumbing fixtures, deck-mounted soap dispensers, and other items indicated on Drawings.
4. Provide manufacturer's standard configuration for exposed edges, back and end splashes, and per the requirements below:
a. Edge and Corner Profiles: Eased.
b. Provide built up edges to standard thickness indicated (1-1/2 inches unless otherwise indicated).
c. Provide 4 inch high back and end splashes, unless otherwise indicated.
5. Window Stools: Scribe window stools to fit jamb conditions as indicated.

2.09 ACCESSORIES & ACCESSORY MATERIALS

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; of width to match component thickness.
1. Provide 3 mm edge banding at all door and drawer front edges and laminate countertop edges.
2. Provide 0.5 mm edge banding (tape) at cabinet body edges, shelf edges, and other semi-exposed/exposed interior edges.
3. Color: To be selected by Architect from Manufacturer's full range.

C. 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.

D. Concealed Joint Fasteners: Threaded steel.

E. Grommets: Standard plastic grommets for cut-outs, in black color unless otherwise indicated.
   1. Grommet Size: To fit 2-1/2 inch diameter cut-out, nominal, unless otherwise indicated.
   2. Grommets shall have removable caps and slot for wire passage.

F. Undercounter Wire Management: Provide the following, as indicated:
   1. Vinyl J-shaped channel wire manager for undercounter mounting, continuous for full length of countertop.

2.10 HARDWARE

A. Support Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated shelf rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Workstation Brackets: Fixed, L-shaped, corner reinforced, face-of-stud mounting. Provide at all countertop/worksurface that is unsupported by cabinetry at 16 inches o.c., unless otherwise indicated.
   1. Materials: Formed steel shapes.
      a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
      b. Color: To be selected by Architect from manufacturer's full range.
   2. Load Capacity: 1000 lbs minimum per pair of brackets, tested at 16 inches o.c. spacing.
   3. Size: Provide nominal sizes below. Provide additional sizes as required for other countertop/workstation applications indicated on Drawings.
      a. Provide 21 inches high by 28 inches deep for standard 30 inch deep countertops.
      b. Provide 21 inches high by 21 inches deep for standard 25 inch deep countertops.
   4. Products:
      a. Rakks Shelving; EH Support Brackets (Basis of Design)
      b. A&M Hardware, Inc; Standard Brackets.
      c. Best Brackets; ADA Workstation Support Standard Steel Bracket.
      d. FastCap; SpeedBrace.
      e. Lyman Associates; Counter Top Supports.
      f. Substitutions: See Section 016000 - Product Requirements.

D. Cabinet Door and Drawer Pulls: BHMA A156.9, B02011
   1. Manufacturers:
      a. Hardware Resources, Elements Gibson Cabinet Pull #105-96SN (Basis of Design)
      b. Miseno Hardware, Sierra Cabinet Pull #MCPTRP2631BSN
      c. Amerock, Rift Cabinet Pull #BP36899G10
      d. Richelieu Hardware, Transitional Metal Pull - 795 #BP795160195
   2. Finish: To be selected by designer from manufacturer's full color range.
   3. Substitutions: See Section 016000 - Product Requirements.

E. Cabinet and Drawer Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish. Provide on all cabinet doors and drawers unless otherwise indicated.

F. Drawer Slides:
   1. Type: Full extension.

2. Static Load Capacity: Heavy Duty grade.
    a. For standard box drawers under 30 inches wide, provide BHMA Grade 1HD-100 with minimum load capacity of 100 lbf.
    b. For file drawers and drawers 30 inches wide or larger, provide BHMA Grade 2HD-200 with minimum load capacity of 200 lbf.
    c. For pencil drawer slides, provide 3/4 extension with minimum load capacity of 45 lbf.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Features: Provide soft close type.
6. Manufacturers:
    a. Accuride International, Inc.
    b. Fulterer USA.
    c. Grass America Inc.
    d. Knape & Vogt Manufacturing Company.

G. Filing Cabinet Suspension System: Provide 14-gauge steel file suspension rails, epoxy powder coated. File followers, or other split bottom hardware, are not acceptable.

H. Hinges: Butt type, BHMA A156.9, Grade 1, 2-3/4 inch, 5-knuckle steel with nickel-plated finish. Provide with antifriction bearings and rounded hospital tips.
1. Provide two hinges for doors less than 48 inches high, and three hinges for doors more than 48 inches high.

I. Hinges: Soft Close European style concealed type, BHMA A156.9, B01602, steel with nickel-plated finish.
1. Provide minimum 110 degree opening standard, and 160 degree opening at ADA sink base cabinets.

2.11 ACCESSORIES

A. Countertop Galley Tipping Rail System: Stainless steel; round posts, rods, all required rail parts
1. Manufacturers:
    a. Hafele; Gallery Rail system, "Article Number 812.20.602" (Basis of Design)
    b. Brass Hardware; "The Orgin Tipping Rail"
    c. Pepe & Carols; "Mini Modern Brass Gallery Shelf Rail"
    d. Bar Fittings Ltd; "Contemporary Shelf Fiddle Rail Brackets"
    e. Rejuvenation; "Modern Tall Gallery Rail"
    f. Substitutions: See Section 016000 - Product Requirements.

B. Keyboard Tray: Integral ball-bearing slides; adjustable tilt, palm rest, cable management, and mouse pad.
1. Manufacturers:
    a. Richelieu Hardware, #504205100 Keyboard Tray (Basis of Design)
    b. Accuride International, Inc; CBERGO-Tray 200.
    c. Doug Mockett; #KP7 / M2-90.
    d. Fulterer; #FR 1602.
    e. Knape & Vogt; # KD-110.
    f. WorkRite Ergonomics; Banana Board.
    g. Substitutions: See Section 016000 - Product Requirements.

2.12 MISCELLANEOUS INTERIOR WOODWORK / CARPENTRY ITEMS

A. Quality Standard: Provide Custom Grade for all interior woodwork / carpentry items, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Refer to Section 064400 - Custom Courts Woodwork and Casework for premium grade woodwork / carpentry items located within courtrooms. Items below ap

C. Trim and Molding: Provide ornamental molding profiles for door trim, chair rail, and crown molding. Profile shall be selected from woodworker's stock profiles that match indicated profile and size on Drawings.
   1. Species and Cut (Transparent Finish): Where transparent stained finish is indicated, provide plain sliced cherry unless otherwise indicated.
   2. Species (Opaque Finish): Provide paint grade, oak or other hardwood species as indicated.
   3. Joints: Provide scarf joints at end-to-end joints and mitered joints at returns and outside and inside corners. Joints shall be tightly fitted and shall have full contact between the two pieces for the full length of the joint.
   4. Provide flat trim pieces with backout/relief cuts on rear face to prevent warping or cupping, except where end will be exposed in the finished work.

D. Wood Veneered Panels: Fabricated flat panels complying with HPVA HP-1, with hardwood plywood core of species compatible with indicated veneer.
   1. Panel Thickness: 3/4 inch.
   2. Veneer Species and Cut: Cherry, plain sliced, book-matched, and architectural end match. Veneers on each panel shall be balance matched for consistent width.
      a. Veneer shall be selected such that all veneers within each space shall be well matched for grain and color.
   3. Exposed ends and edges shall match faces.
   4. Outside corners shall be mitered and splined.
   5. Reveals: Unless decorative metal reveals are indicated, provide black painted substrate prior to installation of panels.
   6. Metal Reveals: Decorative millwork trim; 1/2-inch wide by depth matching wood panels (3/4-inch standard), straight edge reveal without front flanges; fabricated of ASTM B221 extruded aluminum, 6063-T5 alloy. Finish shall be selected from manufacturer's full range of anodized and powder coated finishes.
      a. Manufacturers:
         1) Basis-of-Design: Fry Reglet; Model MWR7550.
         2) Flannery, Inc.
         3) Gordon, Inc.
         4) Pittcon Industries.
         5) Tamlyn.

E. Closet and Utility Shelving: Provide 3/4 inch thick panels and cleats with closet rod mounted to cleats below shelf.
   1. Shelf Material: Decorative thermoset panels, with PVC T-mold edge.
   2. Rod and Flange Material: 1-5/16 inch diameter, aluminum tube, with matching flanges.

2.13 FABRICATION

A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
   1. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.
   2. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
   3. Seal or prime paint concealed cut edges of wood and laminate casework.

D. Hardware Application: Factory-machine casework members for hardware that is not surface applied.

E. Apron Frames: Construction similar to other cabinets, with modifications.
   1. Frames fabricated from panels standard with the manufacturer. Include front and back panels, with drawer suspension framing mechanically fastened to support channels spanning between them.

F. 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 exposed edges.

G. Solid Surfacing: Fabricate in one piece to greatest extent possible; join pieces with adhesive sealant and finish joints smooth in accordance with manufacturer's recommendations and instructions.
   1. Fabricate with butt-jointed / square edge at all solid surface corners. Mitered solid surface corners are not acceptable.

H. Countertop Fabrication: Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall, or as indicated.
   2. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

I. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Height: 4 inches, unless otherwise indicated.
   2. Mechanically fasten back and end splashes to countertops with steel brackets at 16 inches on center.

J. Wall-Mounted Counters (not mounted over cabinets): Provide ADA compliant knee space with brackets, skirts, or aprons, as indicated on Drawings.

2.14 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 3, Lacquer, Postcatalyzed OR System - 5, Varnish, Conversion.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Environmental Conditions:
   1. Do not deliver woodwork or 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. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 inch 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, and provide field modifications as required to not exceed maximum height dimensions.
   1. Construction tolerances shall not apply to casework maximum height dimensions; maximum indicated dimension shall be maintained at any point along the length of casework, regardless of floor levelness.
   2. Field modifications shall be made to the toe kick to account for leveling due to floor levelness.

C. For Wall Cabinets Installation: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
   1. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 ft and 1/2 inch in 20 ft or more, and/or maximum variation from plumb exceeds 1/4 inchper story.
   2. Maximum Variation of finished gypsum board surface from true flatness: 1/8 inch in 10 feet in any direction.

D. Verify adequacy of backing and support framing.

E. 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(s) indicated and in accordance with manufacturer's instructions.

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. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
   1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
   2. Variation of Bottoms of Wall Cabinets from Level: 1/8 inch in 10 feet.
   3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
   4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
   5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

G. Secure wall cabinets at top and bottom, at each end and no more than 16 inches on center. Secure directly into metal wall framing, or into FRT wood or metal channel blocking with No. 10 wafer head screws. Wall mounted hanger strips are not acceptable.

H. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.

I. 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. Test installed work for rigidity and ability to support loads.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

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 workmen from standing on, or storing tools and materials on casework or countertops.

C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION 064100

SECTION 064400
CUSTOM COURTS WOODWORK AND CASEWORK

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Scope: This section covers courtroom-specific, custom woodwork requirements fabricated to AWS "Premium" grade. It is intended to be supplementary to Division 06 Section "Architectural Woodwork and Casework," and the general requirements of that section shall be required for the work of this section.

B. Preinstallation Meeting: Cover courtroom-specific woodwork in the preinstallation meeting as required by Division 06 Section "Architectural Woodwork and Casework."

1.03 SUBMITTALS

A. Provide submittals concurrently for both Division 06 Section "Architectural Woodwork and Casework" and for this section.

B. Product Data: Provide data indicating materials and finishes, woodwork profiles, panel construction, hardware, and accessories.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Include field measurements, and indicate where field measurements differ from documents.

D. Selection Samples: Submit manufacturer's color charts indicating full range of available colors, for each product requiring color selection.

E. Verification Samples: Submit physical samples of architectural woodwork profiles and paneling, minimum 8 inches square or 8 linear inches in length, illustrating proposed shapes, sizes, and finishes of panels, moldings, and other profiles.

1. For each solid wood or wood veneered product indicated to receive transparent finish, provide at least three samples illustrating standard range of wood grain, stain color, and sheen, for selected color.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with documented experience.

1. Fabricator shall be an accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
2. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide third-party final inspection of installed woodwork by AWI (QCP). AWI program of self-certification by fabricator in lieu of third-party inspection is not acceptable.

3. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
4. Provide designated labels on shop drawings as required by certification program.
5. Provide designated labels on installed products as required by certification program.
6. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
7. Replace, repair, or rework all work for which certification is refused.

1.05 MOCK-UPS

A. Provide mock-up in one courtroom, including a section of spectator rail, wall paneling, and molding. Include hardware, finishes, and accessories. This mock-up will be used to determine both quality of fabrication and installation and also veneer and finish matching across multiple elements in the same courtroom.

B. Locate where directed.

C. Mock-up may remain as part of the work after approval.

1.06 DELIVERY, STORAGE, HANDLING, AND FIELD CONDITIONS

A. Comply with Section 2 of the Architectural Woodwork Standards: "Care & Storage" and the requirements of Division 06 "Architectural Woodwork and Casework."

PART 2 PRODUCTS

2.01 CUSTOM COURTROOM CASEWORK AND WOODWORK

A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. General: Provide assemblies fabricated to dimensions, profiles, & general details indicated and coordinated with related work provided under other sections of these specifications. Coordinate indicated work with construction of stepped platform as indicated on Drawings and specified in Division 6 Section "Rough Carpentry."

1. Internal construction and extent of prefabrication of complete assemblies shall be in accordance with final shop drawings. Drawing indications of 2x lumber internal framing are intended to represent "generic" internal construction. Particleboard material is generally preferred for case type pieces, lumber or particleboard for "paneling" type applications as determined by woodworker to be most beneficial for the specific woodwork item. Similarly, joinery details indicated depict options conforming to "Premium" grade criteria specified.
2. Maintain smooth curves and radii for exposed surfaces. Provide bending grade panel material and utilize laminated multiple layers as determined by woodworker to attain required curved surfaces. Fabricate radiused top edge trim in accordance with "Premium" grade criteria of AWI Section 6 "Radius Moldings."
3. Provide for electrical wiring, cabling, etc., as required for complete installation. Coordinate all electrical device outlet locations with Division 26 work and electrical Drawings. Such devices include, but are not limited to, microphones, audio mute, audio priority, data, telephone, video, speakers, and receptacles.
4. Coordinate with pneumatic tube stations (work of Division 14) to provide woodwork trim where stations are indicated in locations with woodwork.
5. Provide flush panel fronts (panel materials with reveals) as indicated in the drawings for indicated assemblies. Provide panel material that can successfully be routed, filled, and sanded sufficiently smooth for paint finish. Edge band exposed panel edges. Construct and support vertical reveals in "bow-front" panel applications to avoid stressed delamination of radiused panel material. (Provide edge banded panels and solid lumber

reveal in lieu of routed reveal if panels are over stressed by radius).

6. Provide stile and rail panel fronts as indicated in the drawings for indicated assemblies. Front construction shall match companion stile and rail paneling specified in other division 6 sections.

C. Quality Standards: Comply with AWS Sections and standards as follows:
   1. AWS Section 10 for "Premium" grade wood cabinets for transparent finish.
      a. AWI Type of Cabinet Construction: Flush overlay.
      b. Wood Species for Exposed Surfaces: Cherry, plain sawn. Run and match grain vertically for veneered panel product material for doors, drawer fronts, and fixed panels.
      c. Wood Species for Semi-Exposed Surfaces: Match species and cut for exposed surfaces.
   2. AWS Section 10 for "Premium" grade wood cabinets for opaque (painted) finish. (Painted finish is specified in Division 9 Section "Painting")
      a. AWI Type of Cabinet Construction: Flush overlay.
      b. Wood Species for Exposed Surfaces: MDO panel product and closed grain hardwood lumber per AWI standard.
      c. Wood Species for Semi-Exposed Surfaces: Match species and cut for exposed surfaces.
   3. AWS Section 11 for "Premium" grade for panel product countertops.
      a. Type of Top: Panel product for transparent finish (wood veneer laminated over various cores).
      b. Veneer Species: Cherry, plain sawn.
      c. Edge Treatment: Lumber matching wood veneer face for species and cut.
   4. AWS Section 11 for "Premium" grade for linoleum countertops.
      a. Type of Top: Linoleum for writing surface tops (conform to AWS Section 11 for HPDL construction). Provide 0.10-inch thickness "desk grade" linoleum in solid black color for bench top finish.
      b. Edge Treatment: Cherry, plain sawn, lumber edge with profiles as detailed.
   5. AWS Section 8 "Wall Surfacing" (paneling) for "Premium" grade as applies to flush panelized fronts of judge's bench assembly and spectator rail elements.
      a. Flat Panel, Transparent Finish: Panel product for transparent finish (wood veneer laminated over various cores). Provide sequenced, book-matched veneers, balance and center matched - i.e. 'blueprint-matched' panels and components per AWS Section 4 for use in continuous front pieces. Provide horizontal grain for bow-fronts only; vertical grain for planar surfaces.
      b. Veneer Species for Exposed Surfaces, Transparent Finish: Cherry, plain sawn.
      c. Reveal and Trim Lumber: Lumber matching wood veneer face for species and cut.
   6. AWS Section 8 "Wall Surfacing" (paneling) for "Premium" grade as applies to stile and rail panelized fronts of judge's bench assembly and spectator rail elements.
      a. Raised Panel: Panel product with mitered, splined, lumber rim, for painted finish.
      b. Flat Panel, Paint Finish: Panel product (wood veneer laminated over various cores) for paint finish. (Paint finish specified in Division 9 Section "Painting")
      c. Veneer Species for Exposed Surfaces, Painted Finish: MDO panel product and closed grain hardwood lumber per AWI standard.
      d. Flat Panel, Transparent Finish: Panel product for transparent finish (wood veneer laminated over various cores). Provide sequenced, book-matched veneers, balance and center matched - i.e. 'blueprint-matched' panels and components per AWS Section 4 for use in continuous front pieces. Provide horizontal grain for bow-fronts

only; vertical grain for planar surfaces.

e. Veneer Species for Exposed Surfaces, Transparent Finish: Cherry, plain sawn.

f. Stiles and Rails: Lumber matching wood veneer face for species and cut.

7. AWS Section 6 "Millwork" and "Ornamental Woodwork" for "Custom" grade as applies to pilasters, pediments, entablatures, and other ornamental trim at backdrops of judges' benches, door surrounds, crown and chair molding, and other locations around perimeter of courtroom, as detailed.

a. Where wall paneling is indicated, match construction and finish of paneling above.

b. For crown and chair molding profiles, final profile shall be selected from woodworker's stock profiles of indicated size.

c. Joints: Provide scarf joints at end-to-end joints and mitered joints at returns and outside and inside corners. Joints shall be tightly fitted and shall have full contact between the two pieces for the full length of the joint.

D. Fabrication of Individual Courtroom Elements:

1. Judge's Bench/Clerk Desk/Probation Officer Desk: Provide assembly as indicated, composed of shop and field constructed elements to best accomplish high quality, close tolerance work as indicated and required. Include "cubicle" components in general composite assembly.

a. Provide counter/casework assembly indicated, featuring painted panel and solid lumber components.

b. Provide linoleum desk top; cherry veneer on panel product at other tops. Provide cherry lumber edge for transparent finish matching wood species on casework surfaces.

c. Provide fiberglass armor protective front construction indicated; sequence construction to maintain the continuity of this protective barrier. Provide back-up strips of armor behind outlet locations, securely fastened to solid blocking as indicated.

d. Provide compouter monitor carriages, keyboard tray, and countertop vision glazing at Judge and Clerk stations.

e. Provide specified routed pulls, and specified slides for pencil and keyboard drawers.

f. Provide ventilation area in indicated cabinet doors by means of four horizontal 1/2-inch by 8-inch-long routed slots with rounded ends, spaced at 1-1/4 inches o.c. Confirm ventilation area location in doors and acceptability of any proposed modifications to slotting pattern on shop drawings prior to fabrication. Fill and sand routed surfaces and paint flat black.

g. Coordinate work with construction of stepped platform.

2. Lecterns (Podiums): Conform to details and dimensions indicated.

3. Witness Box and Podium: Conform to details and dimensions indicated.

4. Spectator Rails: Conform to details and dimensions indicated. Secure railing assemblies to concrete floor with fabricated steel channels as indicated; sequence construction to permit installation. Coordinate with edge of raised flooring (platform/access flooring), and with concrete slab depressions.

5. Tables and other freestanding custom casework items: Conform to details and dimensions indicated.

6. Lobby Security/Entry Desk: Provide assembly as indicated, composed of shop and field constructed elements to best accomplish high quality, close tolerance work as indicated and required. Include "cubicle" components in general composite assembly.

a. Provide counter/casework assembly indicated, featuring painted panel and solid lumber components, and solid surface countertop.

b. Provide ventilation area in cabinets as indicated by means of routed slots with rounded ends, size and spacing as indicated. Confirm ventilation area location in

doors and acceptability of any proposed modifications to slotting pattern on shop drawings prior to fabrication. Fill and sand routed surfaces and paint flat black.

c. Provide cherry veneer on panel product at horizontal wall caps, stiles and rails, and other construction indicated to receive transparent finish, including profiled edge matching wood species on casework surfaces.

d. Provide paint-grade closed-grain hardwood veneer panels at construction indicated to receive opaque (painted) finish.

e. Provide fiberglass armor protective front construction indicated; sequence construction to maintain the continuity of this protective barrier. Provide back-up strips of armor behind outlet locations, securely fastened to solid blocking as indicated.

f. Provide fabricated vision glazing assembly; with vertical steel posts, ballistic rated glazing panels and steel channel frame, and decorative steel ball cap. Paint all steel elements to match.

g. Provide computer monitor carriages, keyboard tray, and ballistic-rated glazing assembly with steel.

h. Provide specified routed pulls, and specified slides for keyboard drawers.

2.02 ACCESSORIES AND HARDWARE

A. Hardware: BHMA A156.9, types as specified in Division 06 Section "Architectural Woodwork and Casework," and as required for AWS "Premium" grade as specified.

B. Accessories: Provide accessories as specified in Division 06 Section "Architectural Woodwork and Casework." Accessories are required as detailed on Drawings and as required by this section.

1. Provide Standard Accessories, including, but not limited to, pulls, slides, adhesives, adjustable shelf standards, grommets and wire management systems, countertop brackets and supports.
2. Provide Specialty Accessories, including, but not limited to, ballistic fiberglass armor, keyboard slides and trays, computer mounts, cash drawers.

2.03 FABRICATION

A. Assembly: Shop assemble casework and woodwork for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, drawers, and exposed edges with specified edging. Do not use more than one piece for any single length. Do not install in a manner that will affect operable components.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Linoleum: Apply linoleum in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel exposed edges.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:

1. Provide sequence matching across each elevation.

F. Provide cutouts for inserts, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.

2.04 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 3, Lacquer, Postcatalyzed OR System - 5, Varnish, Conversion.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

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 grades indicated.

B. Set and secure custom casework and woodwork in place, assuring that they are rigid, plumb, and level.

C. Use concealed joint fasteners to align and secure adjoining elements.

D. Carefully scribe casework and woodwork abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure casework and woodwork to floor using appropriate channels, framing, and anchorages, as detailed.

F. 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. Test installed work for rigidity and ability to support loads.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, woodwork, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 064400

SECTION 071300
SHEET WATERPROOFING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

D. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

F. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at the Project site; at minimum one week prior to commencing work of this section.

1. Review required surface/substrate conditions and preparations, field conditions for application and curing/drying time, special installation details and procedures, inspection, and protection and repair.

1.03 SUBMITTALS

A. Product Data: Provide data for waterproofing membrane and for drainage panel.

B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

C. Installer's qualification statement.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified; approved and/or certified in writing by manufacturer for installation of specified products.

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer materials-only warranty for material failure or waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

C. Provide two year installer's warranty covering faulty workmanship/installation.

1. Warranty shall include removal and reinstallation of drainage panels.

PART 2 PRODUCTS

2.01 SHEET WATERPROOFING MATERIALS

A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Thickness: 60 mil, 0.060 inch, minimum.
   2. Tensile Strength:
      a. Membrane: 250 psi, minimum, measured in accordance with ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
   3. Elongation at Break: 300 percent, minimum, measured in accordance with ASTM D412.
   4. Water Vapor Permeance: 0.05 perm, maximum, measured in accordance with ASTM E96/E96M.
   5. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
   6. Water Absorption: 0.2 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
   7. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 200 feet head of water applied in accordance with test method ASTM D5385/D5385M.
   8. Puncture Resistance: 40 lb, minimum, measured in accordance with ASTM E154/E154M.
   9. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   10. Available Products:
      a. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861.
      b. CETCO, a division of Minerals Technologies Inc; ENVIROSHEET.
      c. GCP Applied Technologies; Bituthene 4000.
      d. Henry Company; Blueskin WP 200.
      e. MAPEI Corporation; Mapethene.
      f. Mar-flex Waterproofing & Building Products; ArmorSheet 600.
      g. Polyguard Products; Polyguard 650.
      h. Tamko Building Products, Inc.; TW-60.
      i. W. R. Meadows, Inc; MEL-ROL.
      j. Substitutions: See Section 016000 - Product Requirements.

2.02 ACCESSORIES

A. General: Provide all accessories required by waterproofing manufacturer for a complete waterproof assembly for substrate and installation type indicated.

B. Primer or Surface Conditioner: Liquid product recommended by waterproofing manufacturer for substrate preparation.

C. Seaming Materials: As recommended by membrane manufacturer.

D. Detail Strip: Self-adhering waterproofing strips, fabricated of same material and thickness as waterproofing membrane, in narrow widths for use at joints and details.

E. Membrane Sealant: As recommended by membrane manufacturer.

F. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.

G. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.

1. Composition: Dimpled molded plastic core; polypropylene or polyester filter fabric bonded to one side, and a polymeric film bonded to the other side. Compressive strength of 15,000 psi.
2. Thickness: 0.40 inch, minimum.
3. Products: One of the following or a comparable product by one of the waterproofing manufacturers listed above.
   a. American Hydrotech, Inc.; Hydrodrain 400.
   b. Carlisle Coatings & Waterproofing, Inc.; CCW MiraDrain 6200.
   c. GCP Applied Technologies; Hydroduct 220.
   d. W.R. Meadows, Inc; Mel-Drain 5035-B.

H. Termination Bars: Aluminum; compatible with membrane and adhesives.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items penetrating surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.

E. Seal moving cracks with sealant and nonrigid filler, using procedures recommended by sealant and waterproofing manufacturers.

F. Prepare building expansion joints at locations as indicated on drawings.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.

D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Install building expansion joints at locations as indicated on drawings.

H. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

I. Seal membrane and flashings to adjoining surfaces.

1. Install termination bar along edges.
2. Install counterflashing over exposed edges.

3.04 INSTALLATION - DRAINAGE PANEL

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward; scribe and cut boards around projections, penetrations, and interruptions.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Manufacturer's technical representative shall provide inspection services no less than 3 times during the course of installation: inspection of substrate conditions and preparations (preinstallation meeting), during membrane and detailing installation, and during drainage/protection board installation.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION 071300

SECTION 072100
THERMAL INSULATION

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. NFPA 259 - Standard Test Method for Potential Heat of Building Materials.

E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.02 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

A. NFPA 285 Tested Assembly: Provide foam plastic insulation products located in exterior wall assemblies that have been tested in accordance with NFPA 285 which represent those exterior wall assemblies for this Project.

1. Potential heat in Btu per square feet shall not exceed the potential heat of the foam plastic insulation contained in the wall assembly tested as determined by tests in accordance with NFPA 259.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect foam-plastic insulation from physical damage, including chipping, cracking, or soiling. Do not use boards that are damaged due to delivery or handling.

B. Store insulation in a manner that protects from damage or deterioration, including moisture, soiling, or UV exposure.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

B. Coordinate with insulation manufacturer for UV exposure requirements and coordinate the schedule of construction to ensure insulation is concealed in a timely manner.

PART 2 PRODUCTS

2.01 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.
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: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
5. Complies with fire resistance requirements as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.

2.02 BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
   3. Facing: Unfaced.

B. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.

2.03 MISCELLANEOUS GAP / CRACK FILLER

A. General: Fill miscellaneous joints and cracks with mineral wool batt insulation (specified above) or with closed-cell polyurethane foam at Contractor's option.

B. Closed Cell Polyurethane Foam:
   1. Provide insulation that conforms to ULC S705.1, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material" or ASTM C 1029, Type II, and performance requirements listed.
   2. Flame-spread index of 0 and maximum smoke development index of 5, when tested in accordance with ASTM E84.
   3. Products:
      a. Dow; Enerfoam Professional Foam Sealant.
      b. Dupont; Great Stuff Pro Gaps & Cracks.
      c. Hilti; CF-AS Crack and Joint All Seasons.
      d. Substitutions: See Section 016000 - Product Requirements.

2.04 ACCESSORIES

A. Tape joints of rigid insulation in accordance with insulation manufacturers' instructions.

B. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

C. 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. Adhere a 6 inches wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.

B. Apply adhesive to back of boards per manufacturer's instructions, or, at Contractor's option install insulation boards to tacky dampproofing/mortar parge coat before it has cured.

C. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive/substrate contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Secure impale fasteners to substrate to manufacturer's required quantity and spacing.

B. Install boards to fit snugly between wall ties.

C. Install boards horizontally on walls.
   1. Install in running bond pattern.
   2. Butt edges and ends tightly to adjacent boards and protrusions.
   3. Place impale fastener locking discs.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.05 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 072100

SECTION 072736
SPRAYED FOAM (SPF) AIR BARRIER

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

B. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.

C. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

F. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.

G. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.

H. CAN-ULC-S705.1 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification.

I. CAN-ULC-S705.2 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application.

J. NFPA 259 - Standard Test Method for Potential Heat of Building Materials.

K. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.03 SUBMITTALS

A. Product Data: Provide product description, insulation properties, and preparation requirements.
   1. Provide current Evaluation Service Report upon request.

B. Compatibility Data: Provide manufacturer's data indicating compatibility between submitted SPF and transition membrane products.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection as required by ABAA QAP.

D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

E. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.04 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP):
   1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.

a. Install shall also be certified by ABAA/BPQI (Building Performance Quality Institute) in accordance with the training requirements outlined in the CAN-ULC-S705.2 Installation Standard. Installers shall have their photo-identification certification cards in their possession and available on the project site, for inspection upon request.

2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

B. NFPA 285 Tested Assembly: Provide foam plastic insulation products located in exterior wall assemblies that have been tested in accordance with NFPA 285 which represent those exterior wall assemblies for this Project.

1. Potential heat in Btu per square feet shall not exceed the potential heat of the foam plastic insulation contained in the wall assembly tested as determined by tests in accordance with NFPA 259.

1.05 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Integrated Exterior Mockups: Attend preinstallation conference for and provide spray-foam components for integrated exterior mockup as indicated on Drawings and as specified in Division 1 Section "Quality Requirements."

1.06 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

1.07 WARRANTY

A. Material Warranty: Manufacturer's standard warranty against manufacturing defects, for a minimum period of 3 years.

B. Installation Warranty: Air barrier subcontractor's installation warranty, effective from date of Substantial Completion for a minimum period of 2 years. Installation warranty shall include all components of the air barrier assembly, including loss of airtight seal, loss of watertight seal, loss of adhesion, loss of cohesion, or failure to cure properly.

PART 2 PRODUCTS

2.01 MATERIALS

A. Spray Polyurethane Foam (SPF) Air Barrier/Insulation: Medium-density, rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

1. Provide insulation that conforms to CAN-ULC-S705.1 or ASTM C1029, Type II, and performance requirements listed.
2. Thermal Resistance: R-value of 6.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
3. Density: Minimum 1.9 pounds per cubic foot.
4. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
5. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
6. Air Permeance (Material): Not to exceed 0.004 cfm per square foot, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.
7. Ozone Depletion Potential (ODP): Zero.

8. Closed Cell Content: At least 90 percent.
9. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
10. Products:
    a. BASF Corporation; WALLTITE US.
    b. Henry Company; Permax 2.0 HFO.
    c. Huntsman Building Solutions; ProSeal HFO Pro.
    d. Johns Manville; JM Corbond IV Closed Cell Spray Polyurethane Foam.
    e. NCFI Polyurethanes; InsulBloc HFO.
    f. Substitutions: See Section 016000 - Product Requirements.

B. Air Barrier Assembly Performance: Air barrier assembly, including primary air barrier and auxiliary materials, including joints and transitions to adjacent materials, shall have an air leakage rate not to exceed 0.04 cfm per square foot, at 1.57 psf pressure differential when tested per ASTM E2357. The air barrier assembly shall also serve as liquid water control layer, and shall be flashed to direct moisture to the exterior.

2.02 ACCESSORIES

A. Compatibility of Materials: Provide sealants, tapes, transition membranes, and other accessory materials that are tested to be compatible with the primary air barrier material and with each other. Provide compatibility charts with product data submittal indicating material compatibility.

B. Primer: As required by insulation manufacturer.

C. Membrane at Transitions in Substrate and Connections to Adjacent Elements: Nominal 40-mil thick, impermeable, self-adhering sheet membrane.
1. Available Products:
    a. Carlisle Coatings and Waterproofing; CCW-705.
    b. Grace Construction Products; Perm-A-Barrier Flashing.
    c. Henry Company; Blueskin SA.
    d. Protective Coatings Technology, Inc; Poly-Wall Crack Guard.
    e. Tremco, Inc.; ExoAir 110.
    f. W. R. Meadows, Inc.; Air Shield.

D. Membrane at Transitions between Spray Foam Air Barrier and Roofing and Other Adjacent Materials: Provide impermeable transition membrane that complies with both air barrier manufacturer's recommendations and adjacent material manufacturer's recommendations.

E. Spray Foam Stop and Screed: L-shaped stop and screed designed as a spray foam termination accessory, fabricated of stable UV-resistant plastic and acceptable to spray foam manufacturer. Outer leg shall be sized to match spray foam thickness indicated. "Jam-Ex" by Exo-Tec Manufacturing, Inc., or equivalent product.

F. Counterflashing for Masonry Through-Wall Flashing: Nominal 40-mil thick, impermeable, self-adhering membrane.
1. Available Products:
    a. Carlisle Coatings and Waterproofing; CCW-705 TWF.
    b. Grace Construction Products; Perm-A-Barrier Flashing.
    c. Henry Company; Blueskin TWF.
    d. Protective Coatings Technology, Inc.; Poly-Wall Crack Guard.
    e. Tremco, Inc.; ExoAir TWF.
    f. W. R. Meadows, Inc.; Detail Strip.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete before insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Apply to the minimum cured thickness indicated on Drawings.

D. Patch damaged areas.

E. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

F. Building Expansion Joints: Do not bridge joints with spray foam material. Provide a L-shaped stop/screed on each side of joint, pack joint with compressible insulation, and bridge the joint with flexible transition membrane to provide continuous air barrier assembly.

G. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Field inspections and tests will be performed by a third party ABAA testing agency.

C. Inspection will include verification of insulation thickness and density.

D. Coordination of ABAA Tests and Inspections:

1. Arrange and pay for testing and inspection required by ABAA QAP.
    a. Testing and inspection shall verify conformance with ABAA Quality Assurance Program, the CAN-ULC-S705.2 Installation Standard, manufacturer's written installation instructions, and other requirements of this section.
    b. Unless indicated otherwise, provide ABAA Quality Assurance Program audits in accordance with current "Frequency & Cost of Audits" posted on ABAA website. Forward written inspection reports to the Architect within 10 working days of the inspection and test being performed. In the case of deficiencies, the ABAA-licensed inspector may verbally advise the licensed installer at time of inspection.
2. Notify ABAA in writing of schedule for air barrier work. Allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

E. In addition to the ABAA site inspector, coordinate and provide access for air barrier manufacturer's technical representative to make field reviews during installation and provide technical reports to Contractor, Owner, and Architect.

F. Patch air barrier work that was removed or damaged due to testing.

G. If testing and inspection reveals any defects, promptly remove and replace defective work at no additional expense to the Owner.

3.05 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION 072736

SECTION 074213.23
METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 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).

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

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

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

F. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

H. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

K. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

L. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives.

M. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

O. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.02 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 MCM installer, CI framing installer (if a different entity), and other relevant sub-contractors (such as aluminum storefront/curtain wall, air barrier, insulation).
2. Include MCM sheet manufacturer’s representative and wall system manufacturer’s representative to review procedures.
3. Review in detail the schedule, personnel, and installation of adjacent materials and substrate.
4. Review project specific details including joint details (both panel-to-panel joints and panel to adjacent construction), penetrations, openings.
5. Review field testing, inspection, and other quality assurance requirements.

6. Review procedures for protection of work and other construction.

1.03 SUBMITTALS

A. 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.

B. 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.

C. 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, 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.
   6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

D. Selection Samples: Submit manufacturer's color charts representing manufacturer's standard range of available colors.

E. Verification Samples: For each finish product specified, submit physical sample in manufacturer's standard size indicating selected colors.

F. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.

G. Test Report: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly utilizing identical products and components to those submitted for installation on this project.

H. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.

I. Installer's qualification statement.

J. Testing agency's qualification statement.

K. Maintenance Data: Care of finishes and warranty requirements.

1.04 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. 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.

C. Installer Qualifications: Company specializing in performing work of type specified in this section.
   1. Approved / certified in writing by wall panel system manufacturer.

D. 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.

1.05 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.
   5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.06 FIELD CONDITIONS

A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.07 WARRANTY

A. See Section 017800 - 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 Owner's name and register with warrantor.

C. Finish Warranty: Provide 30-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Composite Material (MCM) Sheet Manufacturers:
   1. ALUCOBOND by 3A Composites USA; Alucobond Plus.
   2. Alcoa, Inc.; Reynobond FR.
   3. Alfrex, LLC; Alfrex FR.
   4. ALPOLIC Materials; ALPOLIC/fr (Fire Retardant core).
   5. Fairview Architectural LLC; VitraBond G2 (Non-Combustible).

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. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
   2. Provide panel jointing and weatherseal using reveal joints and gaskets but no sealant.
   3. Provide panel jointing and weatherseal using rainscreen "spline" type system. "Wet seal" exposed sealant joints are unacceptable except for perimeter and horizontal joints.
   4. Anchor panels to supporting framing without exposed fasteners.

B. NFPA 285 Fire Propagation Test: Exterior metal-faced composite material wall panel assemblies shall be tested and pass NFPA 285; assembly shall have been tested using identical products and components to those submitted for installation on this project.

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 to 180 degrees F 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. Fire Performance: Provide panels that have been tested in approved assemblies, in accordance with, and complying with acceptance criteria of NFPA 285.

2.04 PANELS

A. Panels: 1 inch deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
   1. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
   2. 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.
   3. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
   4. Fabricate panels under controlled shop conditions.
   5. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
   6. 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.
   7. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.
   8. For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets.
   9. Provide means of concled drainage for panel condensation and water that might accumulate in members of system; drill perforated weep holes on underside return of each panel, and provide insect baffle at each weep hole.

2.05 MATERIALS

A. Metal Composite Material (MCM) Sheet: Fire-retardant composite panel fabricated of two sheets of aluminum sandwiching a mineral-filled core; no foamed insulation material content.
   1. Overall Sheet Thickness: 0.157 inch, minimum (4 mm).
   2. Face Sheet Thickness: 0.020 inches, minimum, equal thickness for both exterior and interior facings. Unequal facings are not acceptable.
   3. 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 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.
   4. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   5. Flammability: Self-ignition temperature of 650 degrees F or greater when tested in accordance with ASTM D1929.

B. Metal Framing Members: Coordinate with Section 054003 - Continuous Insulation (CI) Framing System, Clipped. Provide manufacturer's recommended sub-girts/furring channels, installation clips, base and sill angles and channels, as required for complete installation over continuous insulation framing system.
   1. Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code.
   2. Aluminum Components: ASTM B209/B209M; or ASTM B221 (ASTM B221M).

2.06 FINISHES

A. Superior-Performing 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.

B. Color/Texture: To be selected by Architect from manufacturer's standard range of 30-year finishes; matching basis-of-design Alpolic "BNT Bone White".

2.07 ACCESSORIES

A. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match MCM sheet.

B. CI Framing System: Refer to Division 5 Section 054003 - Continuous Insulation (CI) Framing System, Clipped.

C. Anchors, Clips, and Accessories: Use one of the following:
   1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
   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.

D. Fasteners:
   1. 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.
   2. Bolts: Stainless steel.
   3. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

E. Joint Sealer: Provide color to match wall panels silicone sealant of type approved by MCM sheet manufacturer, and in compliance with ASTM C920.

F. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices, and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine dimensions, tolerances, and interfaces with other work.
   1. Verify that air barrier system/insulation and CI framing system are properly installed.

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 of length and up to 3/4 inch in 300 feet, maximum.
   2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
   3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
   4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

I. Replace damaged products.

1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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 074213.23

SECTION 075423
TPO MEMBRANE ROOFING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

F. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

I. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.

J. FM (AG) - FM Approval Guide.

K. FM DS 1-28 - Wind Design.

L. NRCA (RM) - The NRCA Roofing Manual.

M. NRCA (WM) - The NRCA Waterproofing Manual.

N. UL (FRD) - Fire Resistance Directory.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at the Project site one week before starting work of this section.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.03 SUBMITTALS

A. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

B. Shop Drawings: Submit drawings that indicate joint or termination detail conditions and conditions of interface with other materials.

1. Include details of tapered insulation and crickets
2. Include edge conditions showing details of roofing assembly connection to wall air barrier material to maintain a continuous air barrier system.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1. Submit in the form of manufacturer's assembly letter, indicating each component of the roofing assembly as specified, and that assembly meets performance requirements and manufacturer's warranty conditions.

D. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Warranty Documentation:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of products specified, with UL-listed roof assemblies for roof systems indicated.

B. Installer Qualifications: Company specializing in installation of roof systems indicated, and approved / certified by roofing manufacturer to install products specified.

C. Insulation Manufacturer Qualifications: Approved by roof membrane manufacturer, and approved and labeled under third party quality program as required by applicable building code.
   1. Insulation Labeling: All foam insulation shall bear the label of testing/inspection agency, and shall include manufacturer identification, product identification, performance characteristics, and other information as necessary to verify code compliance for intended end use.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.06 FIELD CONDITIONS

A. Do not install roofing materials during unsuitable weather, or when unsuitable weather is expected. Proceed only when field conditions are in accordance with roofing manufacturer's installation and warranty requirements.

B. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

C. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Special Warranty - Manufacturer: Manufacturer's warranty form, customized for project-specific conditions.
   1. Manufacturer's warranty shall be a "total system" or "edge-to-edge" warranty; no dollar limit ("NDL").
   2. Include all components of roofing system including, but not limited to, roofing membrane, roof insulation, adhesives and fasteners, flashings, edge metals and copings, substrate

board, vapor retarder/air barrier, roof insulation, and cover board.

3. Manufacturer's Total System Warranty Period: 20 years, from date of Substantial Completion.

C. Special Warranty - Installer: Installer shall sign and submit per warranty form attached at end of this section.

1. Installer's warranty shall cover all components of roofing system, matching manufacturer's warranty above.
2. Installer's Warranty Period: 2 years, from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:

1. Carlisle Roofing Systems, Inc.
2. Elevate.
3. GAF.
4. Johns Manville.

2.02 ROOFING

A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over cover board, insulation, vapor retarder/air barrier, substrate board, and metal roof decking.

B. Roofing Assembly Performance Requirements:

1. General: Installed roofing assembly and all associated components shall remain secure and watertight and shall withstand weather exposure, wind uplift pressures specified, and thermal movements. Roofing manufacturer shall certify that all roofing assembly components are compatible with each other and with adjacent materials for applications indicated.
2. Roof Covering External Fire Resistance Classification: UL (FRD) Class A.
3. Assembly Resistance to Internal Fire: Manufacturer's assembly shall be tested to and satisfactorily pass NFPA 276 or UL 1256.
4. Wind / Uplift Design: Membrane roofing system shall be identical to system that has been successfully tested by a qualified testing and inspecting agency to resist uplift pressures calculated according to ASCE 7 as established by applicable building code and loading indicated.
    a. Corner, Perimeter, Field-of-Roof Uplift Pressures: Per applicable building code and values indicated on Structural Drawings.
    b. Static Uplift: In addition to uplift requirements above, system shall be tested for static uplift per FM 4474, UL 580, or UL 1897.
5. Assembly Thermal Resistance (R-Value): Provide roof assembly with a minimum assembly R-value of R-30 in accordance with applicable IECC requirement for commercial roofing.
6. Accelerated Weathering: 2,000 hours minimum exposure, when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
7. Ponding Water: Ponding water shall not remain on the roof 24 hours after a rainfall event.

2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:

1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims.

a. Thickness: 60 mil, 0.060 inch, minimum.
2. Sheet Width: Factory fabricated into widest possible sheets.
3. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Flexible Flashing Material: Same material as membrane.

2.04 DECK SUBSTRATE BOARD

A. Deck Substrate Board: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
1. Thickness: 1/2 inch, fire-resistant.
2. Products:
a. CertainTeed Corporation; GlasRoc Sheathing.
b. Georgia-Pacific; DensDeck Prime.
c. National Gypsum Company; DEXcell Glass Mat Roof Board.
d. USG Corporation; Securock Ultralight Glass-Mat Roof Board.

2.05 VAPOR RETARDER / AIR BARRIER

A. Vapor Retarder / Air Barrier Sheet, Self-Adhered: Composite sheet fabricated of rubberized asphalt factory laminated to polyethylene/polypropylene film with release liner. Product shall be approved by primary roofing manufacturer, and comply with the following:
1. Total Thickness: 30 mils, minimum.
2. Air Permeance: Less than 0.004 cfm/sq.ft. when tested per ASTM E2178.
3. Vapor Permeance: Less than 0.1 perm when tested per ASTM E96/E96M.
4. Products:
a. Carlisle; VapAir Seal 725 TR.
b. Elevate; V-Force Vapor Barrier.
c. GAF; SA Vapor Retarder XL.
d. Johns Manville; JM Vapor Barrier SA.

2.06 COVER BOARDS

A. Cover Board: High compressive strength polyisocyanurate (ISO) board insulation complying with ASTM C1289, and the following characteristics:
1. Classifications:
a. Type II - Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
1) Class 4 - Faced with coated or uncoated glass fiber mat facers on both major surfaces of the core foam. This product is used at a maximum thickness of 1/2 inch (12.7 mm).
(a) Compressive Strength: 109 psi, minimum.
2. Board Size: 48 by 48 inches, maximum.
3. Board Thickness: 1/2 inch.
4. Thermal Resistance: R-value of 2.5, minimum, at 1/2 inch thick and 75 degrees F mean temperature.
5. Products:
a. Carlisle; SecurShield HD.
b. Elevate; Isogard HD Cover Board.
c. GAF; EnergyGuard HD.

d. Johns Manville; ProtectoR.

2.07 INSULATION

A. Surface Burning Characteristics: Foam plastic insulation shall have a maximum flame spread index of 75, and maximum smoke developed index of 450, when tested in accordance withASTM E84 at maximum thickness intended for use.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type II:
         1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
         2) Compressive Strength: Grade 2 - 20 psi, minimum.
   2. Tapered Board: Slope as indicated, but no lower than 1/4 inch per foot; minimum thickness 1/2 inch; fabricate of fewest layers possible.
   3. Preformed Shapes: Provide saddles crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated, but no less than 1/4 inch per 12 inches, and no less than 1/8 inch per 12 inches in valleys.

2.08 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Sheathing Joint Tape: Paper type, self adhering.

C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

D. Membrane Adhesive: As recommended by membrane manufacturer.

E. Insulation Adhesive: As recommended by insulation manufacturer.

F. Sealants: As recommended by membrane manufacturer.

G. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Roofing membrane manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and other accessories are in place.

3.02 PREPARATION - METAL DECK

A. Install deck sheathing on metal deck:
   1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.

2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
3. Tape joints.
4. Mechanically fasten sheathing to roof deck, in accordance with Factory Mutual recommendations and roofing manufacturer's instructions.
    a. At locations where metal roof deck will be exposed from below in the finished work, carefully coordinate fastener attachment such that fasteners do not penetrate the bottom flanges of the metal deck. Remove fasteners that penetrate the bottom flanges and replace with properly located fasteners, and restore metal deck to Owner's satisfaction.

3.03 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

3.04 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder over sheathing surface in accordance with manufacturer's instructions.
    1. Extend vapor retarder under blocking to deck edge.
    2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Attachment of Insulation:
    1. Mechanically fasten first layer of insulation to deck in accordance with roofing manufacturer's instructions and FM DS 1-28 Factory Mutual requirements.
        a. At locations where metal roof deck will be exposed from below in the finished work, carefully coordinate fastener attachment such that fasteners do not penetrate the bottom flanges of the metal deck. Remove fasteners that penetrate the bottom flanges and replace with properly located fasteners, and restore metal deck to Owner's satisfaction.
    2. Embed subsequent layer(s) of insulation into either ribbons or full bed of adhesive as required to comply with performance or warranty requirements, and in accordance with roofing and insulation manufacturers' instructions.
    3. Install a minimum of two layers of insulation, with a minimum total thickness of 5 inches, to achieve a cumulative Long Term Thermal Resistance (LTTR) value of 28.5 per ASTM C 1289, followed by a cover board.

D. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

E. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

F. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

H. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.

I. Do not install more insulation than can be covered with membrane in same day.

J. Cover Boards: Secure cover boards in accordance with roofing manufacturer's instructions with manufacturer's insulation adhesive. Install cover boards with joints staggered minimum 6 inches from joints of preceding insulation layer.

3.05 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate per manufacturer's instruction. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by heat welding, minimum 3 inches. Seal permanently waterproof.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Install roofing expansion joints where indicated. Make joints watertight.

H. Coordinate installation of roof drains and sumps and related flashings.

I. Install walkway pads in layout indicated. If not indicated, provide from roof access hatch/door to each major piece of rooftop equipment and fully around perimeter of equipment. Space pad joints to permit drainage.

3.06 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide on-site inspection by roofing manufacturer's technical representative at least three times (deck/substrate examination, in-progress, and warranty inspection) during installation of this work.

C. Repair or replace roofing components where inspection determines they are defective.
   1. Repair or replace roofing system where ponding occurs in excess of specified requirement.

3.07 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

D. Provide a final cleaning of the roof membrane immediately prior to Substantial Completion to remove dirt, clay and other soiling.

3.08 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION 075423

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 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).

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

G. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

H. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.02 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used including technical material properties.
   1. Include installation instructions and manufacturer's recommendations for installation and maintenance.
   2. Include ANSI/SPRI/FM 4435/ES-1 wind pull-off performance data for systems that will be used in edge metal conditions.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Selection Samples: Provide manufacturer's color charts for each product and material requiring color selection.

D. Verification Samples: Submit physical samples, manufacturer's standard size, for each selected color.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work, with experience in projects of size and scope similar to this Project.

1.04 MOCK-UP

A. See Section 014000 - Quality Requirements for additional requirements.

B. Integrated Exterior Mockup: Attend preinstallation conference and provide metal flashing/trim work for integrated exterior mockup as indicated on Drawings and as specified in Division 1 Section "Quality Requirements."

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. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge (0.028-inch) thick base metal, shop pre-coated with PVDF coating.
   1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: To be selected by Architect from Manufacturer's full range.

B. Pre-Finished Aluminum: ASTM B209/B209M; 18 gauge, 0.040 inch thick; plain finish shop pre-coated with PVDF coating.
   1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; pretreated metal with two-coat system including primer and color coat with at least 70 percent PVDF coating.
   2. Color: To be selected by Architect from Manufacturer's full range.

C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 24 gauge (0.025-inch) thick; smooth No. 2D finish.

D. Copper: ASTM B370, cold rolled 16 oz/sq ft, 24 gauge, 0.0216 inch thick; natural finish.

2.02 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; 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. Tin edges of copper sheet to be soldered; solder shop formed metal joints, and after soldering, remove flux, wipe and wash solder joints clean; provide weathertight joints.

F. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.
   1. Hem exterior corners of flashings and drip edges, in a manner that eliminates sharp, exposed cut metal edges, at locations below 6'-0" above grade (locations within reach range of building occupants).

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.03 GUTTERS AND DOWNSPOUTS

A. General: Provide minimum 0.040-inch aluminum extrusions for gutters and minimum 0.032-inch aluminum for downspouts. Finish all parts of gutter/downspout system a single color to match, including brackets, elbows and bends, and exposed fastener heads.

B. Gutters: SMACNA Ogee profile (Style K); unless otherwise indicated.

C. Downspouts: Rectangular profile; unless otherwise indicated.

D. Gutter and Downspout Sizing: Unless otherwise indicated, provide 4-inch deep by 5-inch wide downspouts, with gutter depth to accept 4-inch deep downspout.

E. Accessories: Profiled to suit gutters and downspouts. Provide additional elbows, bends, extended bracket depths, and other accessories as required for downspouts to avoid conflict with cladding profiles, masonry or precast extrusions, and other surface ornamentation on wall.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Straps and spacer bars (SMACNA figure 1-17), spaced no more than 24 inches on center.
   3. Downspout Supports: Brackets; spaced no more than 60 inches on center.
   4. Downspout Strainers: Provide ball-type mesh strainer at each downspout; pre-fabricated, non-corrosive construction compatible with gutter/downspout material.

F. Splash Blocks: Precast concrete type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment. Lightweight "patio" blocks are not acceptable.
   1. Provide a splash block at all conditions where downspout is not indicated to connect to downspout boot, and at conditions where downspout empties onto lower roof.

G. Downspout Boots: Cast iron, inlet sized to match downspout; outlet sized for underground drainage piping. Coordinate with Plumbing Drawings and Division 22.

H. Seal metal joints.

2.04 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.

F. Reglets and Counterflashings (Masonry): Embedded type, copper. Coordinate with Division 4 Section "Unit Masonry."

G. Reglets and Counterflashings (Non-Masonry): Surface mounted two-piece reglet and counterflashing, or one-piece counterflashing, fabricated of pre-finished aluminum or galvanized steel.

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 and one-piece counterflashings true to lines and levels, and seal tops with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. Comply with SMACNA installation instructions and drawing details.

B. For reglets installed into masonry veneer, furnish reglets to mason for installation as Division 4 Unit Masonry work progresses.

C. Insert flashings into reglets to form tight fit; secure in place with wedges; seal flashings into reglets with sealant.

D. Secure flashings in place using concealed fasteners.

E. Apply plastic cement compound between metal flashings and felt flashings.

F. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

G. Seal metal joints watertight.

H. Secure gutters and downspouts in place with concealed fasteners.

I. Slope gutters 1/4 inch per 10 feet, minimum.

J. Connect downspouts to downspout boots, and grout connection watertight.

K. At low roof conditions, and where not indicated to connect to downspout boots, provide a bottom elbow and set splash blocks under downspouts.

END OF SECTION 076200

SECTION 077100
ROOF SPECIALTIES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. NRCA (RM) - The NRCA Roofing Manual.

1.02 SUBMITTALS

A. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Roof Specialties: Provide products by primary roofing manufacturer per Division 7 roofing section or approved by primary roofing manufacturer, as required to meet requirements and comply with terms of manufacturer's total system warranty.

2.02 COMPONENTS

A. Roof Penetration Sealing Systems: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

B. Multiple Penetration/Pipe Housing: Where multiple penetrations are required in close proximity, provide pipe chase housing fabricated of structural aluminum or galvanized steel curb, pre-finished aluminum chase housing with removable top cover, and individual gasketed pipe seals which exit the side walls of the housing. Size housing and provide number and size of pipe seals as required for each application.

1. Manufacturers:
    a. Alta Products, LLC; Sigrist Pipe Chase Housing.
    b. Roof Penetration Housings, LLC; the Vault.

2.03 ACCESSORIES

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

B. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

1. Provide stainless steel fasteners for all exterior construction and for fastening aluminum and stainless steel fabrications.

C. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Install components weathertight; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

C. Seal joints within components when required by component manufacturer.

D. Anchor components securely.

E. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

F. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

END OF SECTION 077100

SECTION 077200
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SUBMITTALS

A. 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.

B. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

1.02 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 CURBS

A. General: Coordinate with Division 22, 23, and 26 for roof curbs and equipment supports specified with specific pieces of equipment.

B. Roof Curbs Manufacturers:
   1. AES Industries Inc.
   2. Curbs Plus, Inc.
   3. The Pate Company.
   4. LMCurbs.
   5. Roof Products & Systems (RPS).
   6. Thybar Corporation.
   7. Substitutions: See Section 016000 - Product Requirements.

C. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
   1. Roof Curb Mounting Substrate: Curb substrate consists of corrugated metal roof deck with insulation.
   2. Sheet Metal Material: Galvanized (zinc-coated) or galvalume (aluminum-zinc alloy) steel sheet; minimum 18 gauge (0.052-inch) thick; mill finish.
   3. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
      a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch clearance between curb and metal roof panel flange allowing water to properly flow past curb.
      b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.

c. Maintain at least 12 inch clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.

4. Provide layouts and configurations indicated on drawings.

D. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
1. Provide preservative treated wood nailers along top of rails.

2.02 ROOF HATCHES AND VENTS

A. Roof Hatch Manufacturers:
1. Bilco Company; Model E-50TB.
2. Milcor, Inc; Thermal Pro TP-1.
3. Nystrom, Inc; ThermalMAX RHTA.
4. Substitutions: See Section 016000 - Product Requirements.

B. Roof Hatches: Factory-assembled aluminum frame and cover, complete with operating and release hardware.
1. Mounting Substrate: Provide frames and curbs suitable for mounting on standing seam metal roof panel system.
a. Coordinate with roof insulation height, including tapered insulation design as indicated, to provide a minimum 8 inch curb height above the highest adjacent point of roof membrane.
2. Thermally Broken Hatches: Provide manufacturer's standard insulation and thermally-broken frame and cover.
3. For Ladder Access: Single leaf; 36 by 36 inches.
4. Operation and Hardware: Provide with manufacturer's standard gas springs with assisted lift and automatic hold open arm. Provide interior and exterior turn handles and interior padlock hasp (padlock NIC).

C. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
1. Material: Mill finished aluminum, 11 gauge, 0.0907 inch thick.
2. Insulation: Manufacturer's standard; 3 inch rigid polyisocyanurate, located on outside face of curb.

D. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
2. Material: Mill finished aluminum; outer cover 11 gauge, 0.0907 inch thick, liner 0.04 inch thick.
3. Insulation: Manufacturer's standard 3 inch rigid glass fiber.
4. Gasket: Neoprene, continuous around cover perimeter.

E. Safety Railing System: Roof hatch manufacturer's standard accessory safety rail system mounted directly to curb. Do not install safety railing to roof assembly.
1. Railing: Comply with 29 CFR 1910.23 for ladder safety, with a safety factor of two.
2. Self-Closing Gate: Comply with 29 CFR 1910.29 for safe egress and fall protection through hatch opening.
3. Posts and Rails: Manufacturer's standard galvanized steel, aluminum pipe, or fiberglass pipe; pre-finished in safety yellow color.
4. Fasteners: Stainless steel, Type 316.
5. Products:

a. BILCO Company; Bil-Guard 2.0.
b. Milcor, Inc.; SAF-T-RAIL.
c. Nystrom, Inc.; Roof Hatch Safety Railing SRC.
d. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

B. Roof Curbs and Equipment Supports: Install in lengths and in a manner such that curbs and equipment supports span multiple structural framing members, with adequate blocking and supports to distribute the equipment loads over metal decking and structural members without crushing.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 077200

SECTION 078400
FIRESTOPPING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

C. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

D. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2.

E. {RSTEMP#1686}ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.{CH#46229}.

F. SCAQMD 1113 - Architectural Coatings.

G. FM (AG) - FM Approval Guide.

H. UL 1479 - Standard for Fire Tests of Penetration Firestops.

I. UL (FRD) - Fire Resistance Directory.

1.02 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Installer's qualification statement.

1.03 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 {\rs\#1} 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. Labeling: Provide permanent labels adjacent to each firestopping assembly. Labels shall be durable metal or plastic and fastened mechanically or with a self-adhering backing. Labels shall include the tested assembly/system number, fire rating of the adjacent building element/ firestopping, the firestopping installer and certification, date of installation, and specific instructions to "Do Not Disturb" and "Alert Building Personnel of Damage."
   1. Coordinate with Division 09 "Painting" for stenciled painted labeling of fire-rated walls and partitions.

C. Installer Qualifications: Company specializing in performing the work of this section and trained/certified by firestopping manufacturer.

1.04 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.
   2. A/D Fire Protection Systems Inc.
   3. Hilti, Inc.
   4. RectorSeal, a CSW Industrials Company.
   5. Specified Technologies Inc.
   6. Tremco Commercial Sealants & Waterproofing.
   7. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero (0) in accordance with ASTM G21.

B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

C. Low-Emitting Materials:
   1. Paints and Coatings: Paints and coatings field-applied inside the weatherproofing system shall be tested and determined compliant in accordance with CAL (CDPH SM) AND shall meet applicable VOC limits of CARB (SCM) or SCAQMD 1113.
   2. Adhesives and Sealants: Adhesives and sealants field-applied inside the weatherproofing system shall be tested and determined compliant in accordance with CAL (CDPH SM) AND shall meet the chemical content requirements of SCAQMD 1168.

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. Temperature Rise: Provide systems that have been tested to show T Rating as indicated, but not less than 1 hour.

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.

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.

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. Air Leakage (Smoke Barriers): Provide systems that have been tested to show L Rating of no more than 5.0 cfm/sq. ft., both at ambient and elevated 400 deg F temperatures.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use system that is listed by FM (AG), {\rs\#1}, 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 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 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.

3.03 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.
   1. Coordinate with Division 09 Painting contractor to ensure that all fire-rated walls and partitions are properly labeled.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 078400

SECTION 078426
THERMAL BARRIERS FOR PLASTICS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

C. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems.

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

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

F. {RSTEMP#1686}ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.{CH#46229}.

G. FM (AG) - FM Approval Guide.

H. UL 1479 - Standard for Fire Tests of Penetration Firestops.

I. UL (FRD) - Fire Resistance Directory.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting at the Project site one week before starting work of this section. Include other relevant installers including installers of any foam plastic materials over which thermal barriers are to be installed.

1.03 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance ratings, and limitations.

B. Product Test Reports: Provide test data indicating compliance with both Temperature Transmission Test and Integrity Fire Test.

C. Evaluation/Compatibility Reports: Provide data indicating tested compatibility with submitted foam plastic material, for each assembly required.

D. Installer's qualification statement.

E. Inspection Reports: Provide inspection reports certified by thermal barrier manufacturer's technical representative, indicating that thermal barrier has been installed in accordance with manufacturer's requirements.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide assemblies that provide 15-minute thermal barrier protection when tested in accordance with both the Temperature Transmission Fire Test and the Integrity Fire Test required by NFPA 275.

1. Temperature Transmission Test: The thermal barrier product shall be tested for standard fire exposure in accordance with ASTM E 119 or ANSI/UL 263.
2. Integrity Fire Test: The thermal barrier assembly, including the specific thermal barrier and foam plastic products submitted for this project, shall be tested as an assembly in accordance with NFPA 276, FM 4880, ANSI/UL 1040, or ANSI/UL 1715.
3. Evidence of passing both test requirements shall be required.

a. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
b. 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.
c. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Surface-Burning Characteristics: Thermal barrier product shall be tested in accordance with ASTM E 84 and shall be rated for plenum exposure with maximum flame-spread index of 25 and maximum smoke-developed index of 50.

C. Installer Qualifications: Company specializing in performing the work of this section and:
1. Trained, certified, or licensed in writing by manufacturer.

D. Manufacturer's Inspection: Manufacturer's technical representative shall inspect foam plastic substrates prior to installation and in-progress work to ensure compliance with manufacturer's requirements, and shall provide inspection reports after each visit.
1. Thermal barrier installer shall coordinate with manufacturer to provide anticipated installation dates.

1.05 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. Thermal Barrier Manufacturers and Products:
1. Cementitious SFRM Thermal Barrier for Cellular Foam:
a. Grace, W.R. & Co.; Monokote Z-3306 Series.
b. Southwest Fireproofing Products, Inc.; 7TB Thermal Barrier.
2. Fire-Resistive, Water-Based, Intumescent Mastic Coating for Cellular Foam:
a. Thermal Product Research (TPR^2); Fireshell.
b. Flame Seal Products, Inc.; Flame Seal TB.
c. International Fireproof Technology, Inc.; DC315.
3. Cellulose SFRM Thermal Barrier for Cellular Foam:
a. International Cellulose Corp.; Ure-K.

2.02 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealants, and other accessory materials as required by manufacturer, that are compatible with the other materials in the thermal barrier assembly and that maintain the thermal barrier rating of the assembly.

B. Mold and Mildew Resistance: Provide thermal barrier and accessory materials with mold and mildew resistance rating of zero (0) in accordance with ASTM G21.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 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.

3.03 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 thermal barriers until special inspections are complete.

C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Special Inspections: Inspection agency employed and paid by Owner, will examine all spray-applied fireproofing, including thermal barriers, in accordance with the IBC edition applicable to this Project.

1. Testing Services: All fireproofing/thermal barriers shall be tested according to ASTM E 605 and ASTM E 736. Mastics shall be tested according to AWCI 12-B.

B. Repair or replace spray-applied fireproofing and thermal barriers at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of thermal barrier overspray; clean all adjacent surfaces after application.

3.06 PROTECTION & REPAIR

A. Protect adjacent surfaces from damage by material installation.

B. If installed thermal barrier must be cut due to subsequent penetrations or other work, provide additional patching work as required to restore thermal barrier to a continuous, complete assembly at the time of Substantial Completion.

C. Repair damage to thermal barriers caused by construction activities; verify that repaired work maintains a continuous, complete thermal barrier assembly.

END OF SECTION 078426

SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.

C. ASTM C834 - Standard Specification for Latex Sealants.

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

E. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

G. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants.

I. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.

J. ASTM C1311 - Standard Specification for Solvent Release Sealants.

K. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

L. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2.

M. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.

N. SCAQMD 1113 - Architectural Coatings.

1.02 SUBMITTALS

A. 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.

B. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

E. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

F. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

G. Executed warranty.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section, and is approved and/or certified by manufacturer.

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.

C. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Test date.
      b. Copy of test method documents.
      c. Age of sealant upon date of testing.
      d. Test results, modeled after the sample form in the test method document.
      e. Indicate use of photographic record of test.

D. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Have a copy of the test method document available during tests.
   3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
   4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
   5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
   6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

E. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
   1. Sample: At least 18 inches long.
   2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the 1-inch mark is that distance from the substrate, the test has failed.
   3. If either adhesive or cohesive failure occurs before minimum elongation, take necessary measures to correct conditions and retest; record each modification to products or

installation procedures.

1.04 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Wall and ceiling joints.
      c. Joints between plumbing fixtures and floor or wall construction.
      d. Other joints indicated below.
   3. Do not seal the following types of joints:
      a. Intentional weep holes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
      c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      d. Joints where installation of sealant is specified in another section.
      e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant (ES-1), unless otherwise indicated.
   1. Type ES-5 - Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
   2. Type ES-1 or ES-2 - Joints between walls and frames of doors, windows, and louvers.
   3. Type SRS-1 - Bedding joints.

C. Interior Joints: Use non-sag polyurethane sealant (ES-4), unless otherwise indicated.
   1. Type ES-3 - Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
   2. Type ES-5 - Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
   3. Type AS-1 - Joints at sound-rated or acoustic assemblies, and at full-height panel wall and partition assemblies indicated to have sound attenuation batts.
   4. Type LS-1 - Joints around perimeters of interior doors, windows, elevator entrances, and similar framed openings.

D. Interior Wet Areas: Bathrooms, restrooms, and kitchens; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

F. Areas Where Tamper- or Pick-Resistance is Required: Within the secure area designated on the Drawings.
   1. Security Sealants shall be used at all construction joints in detainee holding and transport areas and areas indicated as I-3 Use Group areas. Joints above ceilings, covered by expansion joints, or otherwise concealed are excluded.
   2. Provide "tamper-resistant" security sealants for supervised areas (corridors, interview rooms, etc.) and "pick-resistant" security sealants for areas not subject to continuous supervision (holding cells). Do not use pick-resistant epoxy in building joints such as control or expansion joints; use tamper-resistant polyurethane at these locations.
      a. Provide tamper resistant polyurethane for all exposed voids between finish materials, and between finish materials and surface mounted devices that inmates could use to hide contraband in inmate-accessible rooms inside the secure perimeter. Provide also at flooring terminations to walls where no base is scheduled (or painted base only), and at joints between ceilings and walls.
   3. Refer to Security and Security Access Control specifications (Divisions 11 and 28) for additional references and requirements for security sealants.

2.02 JOINT SEALANTS - GENERAL

A. Low-Emitting Materials:
   1. Paints and Coatings: Paints and coatings field-applied inside the weatherproofing system shall be tested and determined compliant in accordance with CAL (CDPH SM) AND shall meet applicable VOC limits of CARB (SCM) or SCAQMD 1113.
   2. Adhesives and Sealants: Adhesives and sealants field-applied inside the weatherproofing system shall be tested and determined compliant in accordance with CAL (CDPH SM) AND shall meet the chemical content requirements of SCAQMD 1168.

2.03 NONSAG JOINT SEALANTS

A. Type ES-1 - Low-Modulus Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Color: To be selected by Architect from manufacturer's full range.
   5. Products:
      a. Master Builders Solutions; MasterSeal NP 100.
      b. Momentive Performance Materials, Inc/GE Silicones; SCS 2000 SilPruf.
      c. Pecora Corporation; Pecora 890 NST (Non-Staining Technology) or 890 FST (Field Tint).
      d. Polymeric Systems, Inc.; PSI-641.
      e. Tremco Commercial Sealants & Waterproofing; Spectrem 3 or Spectrem 4-TS (Field Tint).
      f. Substitutions: See Section 016000 - Product Requirements.

B. Type ES-2 - Medium-Modulus Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: To be selected by Architect from manufacturer's full range.
5. Manufacturers:
   a. Dow Chemical Company; DOWSIL 795 Silicone Building Sealant.
   b. Momentive Performance Materials, Inc/GE Silicones; SCS9000 SilPruf NB - Non-Staining Silicone Weatherproofing Sealant.
   c. Pecora Corporation; Pecora 895 NST (Non-Staining Technology).
   d. Tremco Commercial Sealants & Waterproofing; Spectrem 2.
   e. Substitutions: See Section 016000 - Product Requirements.

C. Type ES-3 - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic. Neutral- or acid-curing per manufacturer standard.
   1. Color: White.
   2. Products:
      a. Dow; DOWSIL 786 Mildew Resistant.
      b. Pecora Corporation; Pecora 898 NST (Non-Staining Technology).
      c. Tremco Commercial Sealants & Waterproofing; Tremsil 600 or Tremsil 200.
      d. Substitutions: See Section 016000 - Product Requirements.

D. Type ES-4 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Color: To be selected by Architect from manufacturer's full range.
   3. Products:
      a. ITW Polymers Sealants; Permathane SM 7200.
      b. Master Builders Solutions by BASF; MasterSeal NP2.
      c. Pecora Corporation; DynaTrol II.
      d. Sika Corporation; Sikaflex-2c NS.
      e. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC or Vulkem 227.
      f. Substitutions: See Section 016000 - Product Requirements.

E. Security Sealant - "Tamper-Resistant" Polyurethane Sealant: ASTM C920, Grade NS, Uses M, G, and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
   2. Hardness Range: 50 to 60, Shore A, when tested in accordance with ASTM C661.
   3. Products:
      a. Master Builders Solutions; MasterSeal CR 195.
      b. Pecora Corporation; DynaFlex SC.
      c. Sika Corp; Sikaflex 11 FC.

F. Security Sealant - "Pick-Resistant" Epoxy Sealant: ASTM C881/C881M, Type I and III, Grade 3, Class B and C; two-component.
   1. Hardness Range: 65 to 75, Shore D, when tested in accordance with ASTM C661.
   2. Products:

a. Euclid Chemical; Dural 452 Gel.
b. Pecora Corporation; DynaPoxy EP-1200 Two-Part Epoxy Security Sealant.
c. Sika Corp; Sikadur 23.
d. Substitutions: See Section 016000 - Product Requirements.

G. Type LS-1 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's full range.
2. Grade: ASTM C834; Grade NF.
3. Products:
a. Bostik, Inc; Chem-Calk 600.
b. ITW Polymers Sealants; SM 8200.
c. Master Builders Solutions; MasterSeal NP 520.
d. Pecora Corporation; AC-20 +Silicone.
e. Tremco Commercial Sealants & Waterproofing; Tremflex 834.
f. Substitutions: See Section 016000 - Product Requirements.

H. Type AS-1 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging acoustical sealant.
1. Color: Standard colors matching finished surfaces, Type OP (opaque).
2. Grade: ASTM C834; Grade NF.
3. Manufacturers:
a. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
b. Franklin International, Inc; Titebond GREENchoice Acoustical Smoke & Sound Sealant.
c. Hilti, Inc; CP 506 Smoke and Acoustical Sealant.
d. Master Builders Solutions; MasterSeal NP 520.
e. Momentive Performance Materials, Inc/GE Silicones; RCS20 Acoustical.
f. Pecora Corporation; AC-20 FTR or AIS-919.
g. Specified Technologies Inc; Smoke N' Sound Acoustical Sealant.
h. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke and Sound.
i. Substitutions: See Section 016000 - Product Requirements.

I. Type SRS-1 - Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
1. Products:
a. Bostik, Inc; Chem-Calk 300.
b. Pecora Corporation; Pecora BC-158 Butyl Rubber Sealant.
c. Tremco Inc.; Tremco Butyl Sealant.
d. Substitutions: See Section 016000 - Product Requirements.

2.04 SELF-LEVELING JOINT SEALANTS

A. Type ES-5 - Self-Leveling Polyurethane Sealant for Traffic: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Products:
a. Bostik, Inc.; Chem-Calk 550.

b. ITW Polymers Sealants; Permathane SM 7201.
c. Pacific Polymers, Inc; Elast-Thane 227 Type 1 (Self-Leveling).
d. Polymeric Systems, Inc; PSI-270SL.
e. Tremco Commercial Sealants & Waterproofing; THC-901 or THC-900.
f. W. R. MEADOWS, Inc; POURTHANE SL.
g. Substitutions: See Section 016000 - Product Requirements.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. 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.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
3. Record each test on Preinstallation Adhesion Test Log as indicated.
4. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.
5. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

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. Install acoustical sealant application work in accordance with ASTM C919.

D. 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.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. 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.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

J. Installation of Security Sealants: Install in locations indicated in accordance with manufacturer's written recommendations.

1. Apply pick-resistant non-flexible 95 shore “A” hardness epoxy type security sealant in all spaces and cracks between similar and dissimilar materials including, but not limited to, metal frames, windows, all fixtures except vitreous china plumbing fixtures, detention furniture, embeds, secure air diffusers, lock columns and receivers.
2. Apply tamper resistant flexible 55 shore “A” hardness security sealant in any open joints located in cells, including joints at the intersections of walls to walls, walls to ceilings and walls to floors.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Destructive Adhesion Testing: If there are any failures in first 1,000 linear feet, notify Architect immediately.

D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

E. Repair destructive test location damage immediately after evaluation and recording of results.

END OF SECTION 079200

SECTION 081113
STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames.

D. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.

1.02 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

C. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.03 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. Ceco Door, an Assa Abloy Group company.
   2. Curries, an Assa Abloy Group company.
   3. Fleming Door Products, an Assa Abloy Group company.
   4. Krieger Specialty Products.
   5. Mesker, dormakaba Group.
   6. Metal Products, Inc. (MPI)
   7. Pioneer Industries, Inc.; an Assa Abloy Group company.
   8. Republic Doors, an Allegion brand.
   9. Steelcraft, an Allegion brand.
   10. Technical Glass Products.

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. Door Top and Bottom Closures: Flush end closure channel, with top and door faces aligned.
    a. Inverted channel closure is acceptable for bottom edges and top edges of interior doors that are not exposed to view from above.
4. Door Edge Profile: Beveled edge.
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.
8. 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. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated. Fabricate from metallic-coated steel sheet.
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, minimum.
    e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Door Core Material: Vertical steel stiffeners with fiberglass batts.
    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
3. Door Thermal Resistance: R-Value of 6, minimum.
4. Door Thickness: 1-3/4 inches, nominal.
5. Weatherstripping: Refer to Division 08 "Door Hardware".

C. Interior Doors, Non-Fire-Rated: Fabricate from either cold-rolled steel sheet or metallic-coated steel sheet.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 2 - Heavy-duty.
    b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.

2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements, except kraft paper honeycomb core is not acceptable.
3. Door Thickness: 1-3/4 inches, nominal.

D. Fire-Rated Doors: Comply with NFPA 80.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Match construction and physical performance levels above for interior or exterior doors, as applicable.
2. Fire Rating: As indicated, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Per NFPA 80, fire exit doors shall be labeled “Fire Door to Be Equipped with Fire Exit Hardware,” and shall be reinforced and constructed to maintain the rating of the specific listed and labeled fire exit devices mounted on them.
4. Provide units listed and labeled by UL (DIR) or ITS (DIR).
a. Attach fire rating label to each fire rated unit.
5. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
6. Door Thickness: 1-3/4 inches, nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Face welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
3. Weatherstripping: Refer to Division 08 Section "Door Hardware".

D. Interior Door Frames, Non-Fire Rated: Face welded type.
1. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.

E. Door Frames, Fire-Rated: Face welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.

F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

G. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.
1. Where removable mullion is indicated, coordinate with removable mullion to be provided as an exit device accessory per Division 08 Section "Door Hardware."

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 in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

K. Frames Wider than 48 inches: 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. Louvers: Roll formed steel with overlapping frame; finish same as door components; factory-installed.
   1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
   2. Style: Sightproof inverted V- or Y-blade.
   3. Fasteners: Exposed or concealed fasteners.

B. Glazing: As specified in Section 088000.

C. Removable and Fixed Stops: Formed sheet steel, mitered or butted corners; prepared for countersink style tamper proof screws.
   1. Provide fixed stops for exterior applications, and toward the secure side of interior glazed lites (for example, toward the corridor or more public accessible spaces).
   2. Heights of Stops: Unless otherwise indicated or recommended by glazing manufacturer, provide standard 5/8-inch height stops where allowed by standards, and provide 3/4-inch height for exterior 1-inch glazing units.

D. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices.
   1. Provide UL listed products, complying with NFPA 80, and as required to maintain indicated fire rating.
   2. Provide surface mounted overlapping-type astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.

E. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

F. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

G. 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.

H. 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 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.
   1. Install in accordance with ANSI/SDI A250.11.
   2. Do not remove temporary frame spreaders until after frames have been properly set and secured.

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 087100.

F. Comply with glazing installation requirements of Section 088000.

G. Coordinate installation of electrical connections to electrical hardware items.

H. Touch up damaged factory finishes.

3.03 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.
   1. Comply with clearances indicated in NFPA 80 for fire-rated doors.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION 081113

SECTION 081416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

C. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

D. UL 10B - Standard for Fire Tests of Door Assemblies.

1.02 SUBMITTALS

A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

B. 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.

C. Selection Samples: Submit manufacturer's color charts indicating full range of available colors, for each product requiring color selection.

D. Verification Samples: Submit three physical samples of door veneer, approximately 8 by 8 inches in size illustrating standard range of wood grain, stain color, and sheen.

E. Warranty, executed in Owner's name.

1.03 QUALITY ASSURANCE

A. Source Limitations: Provide all flush wood doors from a single manufacturer.

1.04 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.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Eggers Industries.
   2. Lambton Doors.
   3. Masonite Architectural; Aspiro Select Wood Veneer Doors.
   4. Oshkosh Door.
   5. VT Industries, Inc.

2.02 DOORS

A. Doors: See drawings for locations and additional requirements.
   1. Doors shall be manufactured by the hot-press method, bonding faces, crossbands, and core together in a single operation with Type I glue. Doors manufactured by cold-pressing 2- or 3-ply pre-manufactured door skins to multiple cores in the same press will not be accepted.

B. Interior Doors: 1-3/4 inches 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.
      a. Provide stile construction with concealed intumescent seals at pairs of doors, meeting required fire-ratings without the need of astragal or metal edge construction.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), particleboard Grade LD-2 per ANSI A 208.1; plies and faces as indicated.
   1. Provide structural-composite-lumber (SCLC) core for doors with glazing area cut out for 9-inch stile width doors.
   2. Provide structural-composite-lumber (SCLC) core for doors with exit devices.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Red oak, 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: Any option allowed by quality standard for grade.
   2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.

C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

D. For doors indicated to be factory-finished, factory install glazing in doors in compliance with quality standards specified, using manufacturer's standard elastomeric glazing sealant.

E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

G. 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 - 5, Varnish, Conversion or System 11, catalyzed polyurethane.
      b. Sheen: Satin.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing where doors will be exposed to view from above.

2.07 ACCESSORIES

A. Wood Louvers:
   1. Material and Finish: Match species of door panels.

B. Metal Louvers:
   1. Material and Finish: Roll formed steel; pre-painted finish to color as selected.
   2. Louver Blade: Inverted V blade, sight proof, light proof; fire rated to indicated rating, with fusible link designed to UL requirements.

C. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws. At fire-rated doors, provide noncombustible wood stops with concealed metal clips for indicated fire rating.

D. Door Hardware: Refer to Section 087100.

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.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

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 081416

SECTION 081433
STILE AND RAIL WOOD DOORS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

C. {RSTEMP#1686}ITS (DIR) - Directory of Listed Products{CH#49476}.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

F. UL (DIR) - Online Certifications Directory.

G. UL 10B - Standard for Fire Tests of Door Assemblies.

1.02 SUBMITTALS

A. Product Data: Indicate stile and rail core materials and construction; veneer species, type and characteristics.

B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, and cutouts for glazing.

C. Selection Samples: Manufacturer's color charts and swatches for hardwood species and stain finishes, indicating full range of materials and colors.

D. Verification Samples: Corner section of door, minimum 8- by 8-inch, indicating stile and rail construction, face and edge veneer, wood species and stain finish, to match that selected.

E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

F. Manufacturer's qualification statement.

G. Warranty, executed in Owner's name.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, FSC-accredited chain-of-custody manufacturer.

B. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide labels or certificates indicating that installed work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver, and store doors in accordance with quality standard specified.

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.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
   1. Provide warranty on glass vision panels for minimum 5 years.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Stile and Rail Wood Doors:
   1. Artistic Doors and Windows, Inc.
   2. Dimension Millworks.
   3. Masonite Architectural; Aspiro Authentic Stile & Rail Doors.
   4. VT Industries, Inc; Eggers Stile and Rail Doors.
   5. Substitutions: See Section 016000 - Product Requirements.

2.02 DOORS

A. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; solid lumber construction; mortise and tenon joints. Transparent finish.

2.03 DOOR AND PANEL FACINGS

A. Veneer Facing for Transparent Finish: Red Oak, 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. Pairs: Pair match each pair; set match pairs within 10 feet of each other when doors are closed.

B. Adhesive: Type II - Water Resistant.

2.04 DOOR CONSTRUCTION

A. Vertical Exposed Edge of Stiles: Of same species as veneer facing.

B. Fit door edge trim to edge of stiles after applying veneer facing.

C. Bond edge banding to cores.

D. Panels: Raised, solid wood. Provide panel layouts as indicated on Drawings.
   1. Panel Trim/Sticking: Selected by Architect from manufacturer's standard range of sticking profiles.

E. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

G. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

H. Factory install glazing in doors in compliance with quality standards specified, using manufacturer's standard elastomeric glazing sealant.

I. Fire Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

J. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252 or UL 10B - Negative (Neutral) Pressure; listed in UL (DIR) or ITS (DIR) and without any visible seals when door is open.

2.05 FINISHES

A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 5, Varnish, Conversion or System - 11, Polyurethane, Catalyzed.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

B. Factory finish doors in accordance with approved sample.

2.06 ACCESSORIES

A. Glazing: See Section 088000.

B. Door Hardware: See Section 087100.

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 standards.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Machine cut for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

A. Comply with specified quality standard for fit, clearance, and joinery tolerances.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

END OF SECTION 081433

SECTION 083100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. {RSTEMP#1686}ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.{CH#49943}.

B. UL (FRD) - Fire Resistance Directory.

1.02 SUBMITTALS

A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

B. Shop Drawings: Indicate exact position of each access door and/or panel unit.

1. Include a schedule indicating wall/ceiling type, door types, sizes, and hardware for each access door required.

1.03 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in “Submittals” Article.

1. This (083100) material specification includes access doors required for Divisions 21 (Fire Suppression), Division 22, (Plumbing), 23 (HVAC) and Division 26 (Electrical) work and any other access doors indicated on Drawings.

PART 2 PRODUCTS

2.01 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Manufacturers:

1. Activar Construction Products Group, Inc. - JL Industries.
2. ACUDOR Products Inc.
3. Babcock-Davis.
4. Best Access Doors.
5. Cendrex, Inc.
6. Karp Associates, Inc.
7. Larsen's Manufacturing Company.
8. Milcor, Inc.
9. Nystrom, Inc.
10. Williams Brothers Corporation of America.
11. Substitutions: See Section 016000 - Product Requirements.

B. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.

1. Material: Steel.
2. Style (Gypsum Board locations): Recessed door panel for infill with wall/ceiling finish.
   a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
3. Style (Masonry locations): Exposed frame, with door surface flush with frame surface.

4. Door Style: Double-skinned hollow panel.
5. Frames: 16-gauge, 0.0598-inch minimum thickness.
6. Double-Skinned Hollow Steel Sheet Door Panels: 16-gauge, 0.059-inch minimum thickness, on both sides and along each edge.
7. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
    a. Provide products listed by {\rs\#1} or UL (FRD) as suitable for purpose indicated.
    b. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
    c. Fire-rated door assemblies shall conform with and be installed in accordance with (1) NFPA 80, (2) door and frame manufacturer's installation instructions, and (3) listing requirements of qualified testing agency.
8. Steel Finish: Primed.
9. Hardware:
    a. Hardware for Fire-Rated Units: As required for listing.
    b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
    c. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 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 083100

SECTION 083323
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. {RSTEMP#1686}ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.{CH#50320}.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

G. NEMA MG 1 - Motors and Generators.

H. UL (DIR) - Online Certifications Directory.

I. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of coiling doors with size, location and installation of service utilities, including electrical, access control, and smoke/fire alarm, as required.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.03 SUBMITTALS

A. Product Data: Provide general construction, electrical equipment, and component connections and details.
   1. Include product data for automatic closing device for fire shutter application, with testing and resetting instructions.

B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
   1. Include diagrams indicating motors, controls, and electrical wiring.
   2. Indicate coordination with smoke and/or fire alarm systems, and show locations of detectors, replaceable fusible links, and release devices.

C. Selection Samples: Manufacturer's color charts, showing full range of factory finishes.

D. Verification Samples: Manufacturer's standard size sample on curtain slat material indicated.

E. Installer's qualification statement.

F. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of type specified, approved by manufacturer for installation of specified products. Installer shall be located no more than two hours from Project site to allow for maintenance callbacks.

B. Products Requiring Electrical Connection: Listed and classified by {\rs\#1}, UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified and indicated.

C. Source Limitations: Provide coiling doors from a single manufacturer, sourced through a single supplier. Obtain operators and controls from door manufacturer or from a manufacturer that is approved by door manufacturer for compatibility.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide two (2) year manufacturer warranty for materials and workmanship for all components of coiling doors. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Doors:
1. Alpine Overhead Doors, Inc.
2. Amarr.
3. C.H.I. Overhead Doors.
4. Clopay Building Products.
5. Cornell Iron Works, Inc.
6. McKeon Rolling Steel Door Co., Inc.
7. Overhead Door Corporation.
8. Raynor Garage Doors.
9. The Cookson Company.
10. Wayne-Dalton, a Division of Overhead Door Corporation.
11. Substitutions: See Section 016000 - Product Requirements.

2.02 COILING DOORS

A. Exterior Coiling Doors: Steel slat curtain.
1. Capable of withstanding positive and negative wind loads of 20 psf without undue deflection or damage to components.
2. Sandwich Slats: Manufacturer's standard, with core of foamed-in-place polyurethane insulation; minimum R-value of 4.88.
    a. Surface Burning Characteristics: Provide insulation with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
3. Slat Size: Manufacturer's standard height and thickness to meet performance requirements; length as required for rough opening width indicated.
4. Guide, Angles: Powder coated steel.
5. Hood Enclosure: Manufacturer's standard; powder coated steel.
6. Electric operation.
7. Mounting: Surface mounted.
8. Locking Devices: Slide bolt on inside, with padlock hasp (Padlock NIC).
9. Finish: As selected by Architect from manufacturer's full range of powder coat finishes.

2.03 MATERIALS AND COMPONENTS

A. Metal Curtain Construction: Interlocking slats.
   1. Curtain Bottom for Slat Curtains: Fitted with steel angles to provide reinforcement and positive contact in closed position; powder coated to match curtain slats.
   2. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
   3. Steel Slats: Minimum thickness, 22 gauge, 0.0299 inch; ASTM A653/A653M galvanized steel sheet, unless otherwise indicated.
      a. Galvanizing: Minimum G90 coating at all doors.

B. Guide Construction: Continuous, of profile to retain door in place, mounting brackets of same metal.

C. Guides - Angle: Two ASTM A36/A36M metal angles, size as required for wind loading, but not less than 1-1/2 by 1-1/2 by 1/8 inch.
   1. Powder coated to match curtain slats.
   2. Coordinate jamb conditions and angle requirements with the work of security drawings, Division 28 Security/Access Control sections, and with the Security Control Systems Contractor (SCSC) for security door position switch and interlocking requirements indicated.

D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.
   1. Minimum Thickness: 0.028-inch; ASTM A653/A653M galvanized steel sheet with G90 coating.
   2. Provide with end mounting brackets and with intermediate reinforcing brackets to prevent sagging.
   3. Powder coated to match curtain slats.

E. Lock Hardware:
   1. For motor operated units, additional lock or latching mechanisms are not required.
   2. Slide Bolt: Provide on single-jamb side, extending into slot in guides, with padlock on one side.

F. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

2.04 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
   1. Provide interlock switches on motor operated units.
   2. Operation Cycles: Provide operators and components that are tested and rated for a minimum of 20,000 cycles, unless otherwise indicated.

B. Electric Operators:
   1. Mounting: Side mounted.
   2. Motor Enclosure:
      a. Exterior Coiling Doors: NEMA MG 1, Type 4; open drip proof.
      b. Interior Coiling Doors: NEMA MG 1, Type 1; open drip proof.
   3. Motor Rating: 1/2 HP; 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 250, Type 4.
7. Brake: Manufacturer's standard type, activated by motor controller.
8. Manual override in case of power failure.
9. Refer to Division 26 and electrical drawings 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. Surface mounted, at interior door jamb.
   2. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
      a. Primary Device: Provide NEMA 4X photo eye sensors as required with momentary-contact control device.
         1) Mount primary photo eye sensor no more than 6 inches above finish floor level.
      b. Secondary Device: Provide non-monitored pneumatic sensing edge; may also serve as weatherstripping for bottom of door.

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. Coordinate installation of electrical service with Division 26 electrical sections.

F. Complete wiring from disconnect to unit components.

G. 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.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

B. Adjust seals around entire perimeter to ensure a weather-tight installation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

3.06 INITIAL MAINTENANCE CONTRACT

A. Provide an Initial Maintenance Contract for maintenance of coiling door system and components for a period of 12 months. Maintenance shall include maximum quarterly intervals (minimum of 4 visits for initial contract), and shall include adjustment, lubrication, and other preventive maintenance, and repair or replacement of defective or worn parts or equipment.

1. Provide service during regular working hours throughout period of this maintenance contract.

END OF SECTION 083323

SECTION 084313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.

B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. 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.

I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

K. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.03 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

C. Selection Samples: Submit manufacturer's color charts representing manufacturer's full range of available colors, for each type of product required.

D. Verification Samples: Submit physical samples in manufacturer's standard size indicating actual panel material and selected colors, for each type of product required.

E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Designer's qualification statement.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 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.

1.05 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.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Material/Labor Warranty: Provide a 2-year material and workmanship warranty, covering failures including but not limited to, structural and performance failures, excessive material deterioration, failure of operating components, and water or air infiltration. Complete forms in Owner's name and register with warrantor.

C. Finish Warranty: Provide 10-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum-Framed Storefront - Exterior High-Performance - Double Thermal Break - Center Set - 2" x 4.5":
   1. EFCO Corp; 403X.
   2. Kawneer North America; 451UT.
   3. Oldcastle Building Envelope; 3000 XT.
   4. Tubelite, Inc; TU 24000 Therml=block.
   5. YKK AP America, Inc; YES 45 XT.

B. Aluminum-Framed Storefront - Interior - Non-Thermal - Center Set - 2" x 4.5":
   1. EFCO Corp; 402.
   2. Kawneer North America; Trifab VG 451.
   3. Oldcastle Building Envelope; FG 3000.
   4. Tubelite, Inc; E14000 Non-Thermal.
   5. YKK AP America, Inc; YES 45 FI.

C. Aluminum-Framed Entrances - Heavy-Duty 2-inch Thick - Insulated - Wide-Stile:

1. EFCO Corp; D518 Durastile.
2. Kawneer North America; 500 Heavy Wall Entrance.
3. Oldcastle Building Envelope; Rugged Entrance.
4. Tubelite, Inc; Monumental Wide Stile Doors.
5. YKK AP America, Inc; 50M.

2.02 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 Position: Centered (front to back).
   2. 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.
   3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   4. 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.
   5. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   6. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements:
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Design Wind Loads: Comply with requirements of ASCE 7 and as indicated on Structural drawings.
      b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 10 psf.
   3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
   4. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
   5. Condensation Resistance Factor of Framing: 56, minimum, measured in accordance with AAMA 1503.
   6. Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F), maximum.
   7. Solar Heat Gain Coefficient (SHGC) Including Glazing: 0.25, maximum, measured in accordance with NFRC 200.

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. Glazing Stops: Flush.

B. Glazing: Refer to Section 088000.

C. Infill Panels (Glazing Type G3): Insulated, aluminum, with edges formed to fit glazing channel and sealed.
   1. Total Nominal Thickness: 1 inch.
   2. Surface Burning Characteristics: Provide assemblies with Class A rating, with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   3. Face Sheets (Front and Back): Equal 0.024-inch smooth aluminum faces bonded to nominal 1/8-inch exterior grade hardboard or high-density corrugated polypropylene.
   4. Core: Rigid polyisocyanurate insulation core; minimum total panel R-value of 6.
   5. Finish: Same as storefront.
   6. Products:
      a. Citadel Architectural Products; GlazeGuard 1000 WR+.
      b. Laminators, Inc; Thermolite/Omega Foam-Ply.
      c. Mapes Architectural Products; Mapes-R Infill.
      d. Substitutions: See Section 016000 - Product Requirements.

D. Swing Doors: Glazed aluminum.
   1. Thickness: 2 inches.
   2. Top Rail: 7 inches wide.
   3. Vertical Stiles: 5 inches wide (wide stile).
   4. Bottom Rail: 12 inches wide.
   5. Glazing Stops: Beveled.
   6. Finish: Same as storefront.

2.04 MATERIALS AND ACCESSORIES

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Metal Extrusions and Accessories:
   1. Metal Trim, Filler, and Closures (Brake Metal): Form interior filler panels for closing ends of partition systems, concealing adjacent structural elements, and for other applications as indicated on Drawings. Form from minimum 0.050-inch aluminum sheet coil, producing a panel of same thickness as partitions or mullions unless otherwise indicated. Incorporate reveals, trim, and concealed anchorages for attaching to adjacent surfaces. Finish trim to match storefront unless otherwise indicated.
   2. Offset Anchorage System: Provide frame anchorage incorporating L-shaped offset anchors and finished extruded interlocking L-shaped cover trim matching storefront framing. Anchorage "clip and cover" system shall be engineered by storefront manufacturer.
   3. Enhanced (High Performance) Sill Flashing: Provide thermally-broken extruded aluminum sill flashing with 2-inch tall back leg and bottom profile with outboard trough and weep holes to direct water to exterior. Provide full-frame-depth end dams mechanically attached to sill flashing extrusion and sealed with silicone. Provide silicone sill flashing splice

sleeves and sealant as required at end dams and penetrations for anchorage. Provide finish to match framing.

D. Sill Flashing Sealant: Elastomeric silicone; compatible with flashing material.

E. Sealant for Setting Thresholds: Non-curing butyl type.

F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.05 FINISHES

A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.

B. Color: To be selected by Architect from manufacturer's standard range; matching Basis-of-Design Kawneer Permafluor "Bone White".

2.06 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: Refer to Section 087100.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all exterior doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 088000.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.

3.05 ADJUSTING

A. Adjust operating hardware and sash 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.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 084313

SECTION 084413
GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.

B. 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.

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

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

H. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

K. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

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.

N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

P. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.03 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

C. Selection Samples: Submit manufacturer's color charts representing manufacturer's full range of available colors, for each type of product required.

D. Verification Samples: Submit physical samples in manufacturer's standard size indicating actual panel material and selected colors, for each type of product required.

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. Designer's Qualification Statement.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 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.

1.05 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.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Material/Labor Warranty: Provide a two (2) year material and workmanship warranty, covering failures including but not limited to, structural and performance failures, excessive material deterioration, failure of operating components, and water or air infiltration. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glazed Aluminum Curtain Wall - Exterior High-Performance - Fiberglass Pressure Plates - Front Set - 2.5" x 6":
   1. EFCO Corp; 5600 XTherm.
   2. Kawneer North America; 1600UT.
   3. Oldcastle Building Envelope; Reliance Thermal.
   4. Tubelite, Inc; 400T Curtainwall.
   5. YKK AP America, Inc; YCO 750 XT.

B. Aluminum-Framed Entrances - Heavy-Duty 2-inch Thick - Insulated - Wide-Stile:
   1. EFCO Corp; D518 Durastile.
   2. Kawneer North America; 500 Heavy Wall Entrance.

3. Oldcastle Building Envelope; Rugged Entrance.
4. Tubelite, Inc; Monumental Wide Stile Doors.
5. YKK AP America, Inc; 50M.

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, where indicated on drawings.
   2. Fabrication Method: Field fabricated stick system.
   3. Glazing Method: Field glazed system.
   4. 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.
   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. 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.
   8. 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 and as indicated on Structural drawings.
      a. Member Deflection: For spans less than 13 feet 6 inches, limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch, whichever is less and with full recovery of glazing materials.
      b. Member Deflection: For spans over 13 feet 6 inches and less than 40 feet, limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch, 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 surface temperature.
      b. Expansion and contraction caused by cycling temperature range of 170 degrees F 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:

D. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:

1. Test Pressure Differential: 15 psf.
2. Test Method: ASTM E331.

E. Air Leakage: 0.06 cfm/sq ft maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.24 psf pressure difference across assembly.

F. Air Leakage: 0.06 cfm/sq ft maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.24 psf pressure difference across assembly.

G. Thermal Performance Requirements:
1. Condensation Resistance Factor of Framing: 56, minimum, measured in accordance with AAMA 1503.
2. Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F), maximum.
3. Solar Heat Gain Coefficient Including Glazing: 0.25, maximum, measured in accordance with NFRC 200.

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. Where not indicated, provide 2.5 inch by 7.5 inch members.
3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Glazing: Refer to Section 088000.

C. Infill Spandrel Panels (Glazing Type G3): Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.
1. Surface Burning Characteristics: Provide assemblies with Class A rating, with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Products:
a. Citadel Architectural Products; GlazeGuard 1000 WR+.
b. Laminators, Inc; Thermolite/Omega Foam-Ply.
c. Mapes Architectural Products; Mapes-R Infill.
3. Total Panel Thickness: 1 inch.
4. Face Sheets (Front and Back): Equal 0.024-inch smooth aluminum faces bonded to nominal 1/8-inch exterior grade hardboard or high-density corrugated polypropylene.
5. Core: Rigid polyisocyanurate insulation core; minimum total panel R-value of 6.
6. Finish: Same as curtain wall.
7. Products:
a. Citadel Architectural Products; GlazeGuard 1000 WR+.
b. Laminators, Inc; Thermolite/Omega Foam-Ply.
c. Mapes Architectural Products; Mapes-R Infill.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209/B209M.

C. Structural Steel Sections (Reinforcing): ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

D. Structural Supporting Anchors Attached to Structural Steel: Design for bolted attachment.

E. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.

F. Concealed Flashings: Stainless steel, 26 gauge, 0.0187 inch minimum thickness or sheet aluminum, 22 gauge, 0.026 inch minimum thickness.

G. Firestopping: Refer to Section 078400.

H. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.

I. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.

J. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

K. Glazing Accessories: Refer to Section 088000.

L. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

A. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.

B. Color: To be selected by Architect from manufacturer's standard range; matching Basis-of-Design Kawneer Permafluor "Bone White".

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. Install firestopping at each floor slab edge in accordance with tested assembly.

H. Pressure Plate Framing: Install glazing and infill panels using exterior dry glazing method; see Section 088000.

I. 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 noncumulative or 0.5 inches per 100 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. Provide services of curtain wall manufacturer's technical representative to inspect for proper installation of system and submit report.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 084413

SECTION 085619
PASS WINDOWS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Furnish anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, to be embedded into concrete or masonry, with setting diagrams and installation, to applicable installer in time for installation.

B. Preinstallation Meeting: Prior to start of installation arrange a meeting on site to familiarize installer and installers of related work with requirements relating to this work.

1.03 SUBMITTALS

A. Product Data: Manufacturer's published data showing materials, construction details, dimensions of components, and finishes.

B. Shop Drawings: Drawings prepared specifically for this project, showing plans, elevations, sections, details of construction, anchorage to other work, hardware, and glazing.

1. For existing and in-place openings show verified field dimensions.
2. Show required opening dimensions and allowance for field deviation.

C. Selection Samples: Color charts for factory finishes.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver pre-fabricated items to project site in manufacturer's standard secure packaging. Transport and store on site in a manner that prevents exposure to the elements.

1.05 FIELD CONDITIONS

A. Existing Conditions: Verify rough opening sizes for pass windows by field measurements prior to fabrication; indicate field dimensions on shop drawings.

1.06 WARRANTY

A. Manufacturer Warranty: Provide manufacturer warranty for 3 years from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer. Warranty shall cover failures in material or workmanship due to, but not limited to, the following:

1. Structural failures or deterioration of metals and finishes beyond expected use and normal weathering.
2. Failure of glazing due to excessive deflection, warping, or bowing of supporting members.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pass/Cashier Windows:
   1. C.R. Laurence Co., Inc.
   2. Creative Industries, Inc.
   3. Quikserv Corporation.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 ASSEMBLIES

A. General Requirements:
   1. Design to fit openings indicated on drawings; design to accommodate deviation of actual construction from dimensions indicated on drawings.
   2. Fabricate frames and sash with corners mitered or coped full depth with concealed welded joints.
   3. Separate dissimilar metals to prevent corrosion by galvanic action by painting contact surfaces with primer or with sealant or tape recommended by manufacturer for the purpose.

2.03 PASS WINDOW ASSEMBLY

A. Sliding Pass Window: Unit consisting of fixed channel header and jambs, integral countertop, and two framed sliding windows; each window shall be independently operable.
   1. Basis-of-Design: C.R. Laurence; "Daisy" model.
   2. Configuration and Size: As indicated on Drawings.
   3. Framing: Manufacturer's standard, extruded aluminum; satin anodized finish. Provide double channel overhead track header to allow each sliding window leaf to move independently.
   4. Countertop: Provide integral countertop; fabricated of stainless steel sheet; 18 inches deep by 2 inches thick.
   5. Hardware: Provide manufacturer's standard top-hung ball bearing rollers. Provide unit with keyed lock.
   6. Provide spring loaded guide pin at countertop for each operable window panel.
   7. Provide with 1/4-inch tempered glazing.

2.04 ACCESSORIES

A. Communication Devices: Coordinate glazing cut out requirements with glazing fabricator.
   1. Standard Talk-Thru: Stainless steel, round, allowing passage of speech at normal volume without distortion.
   2. Amplified Talk-Thru:
   3. Integrated Unit with Microphone, Speaker, and Call Button:

2.05 MATERIALS

A. Aluminum Components: ASTM B221 (ASTM B221M) extrusions of alloy and temper selected by manufacturer for strength, corrosion resistance, and finish required; not less that 1/8 inch thick at any location of frame and sash members.

B. Stainless Steel Sheet: ASTM A666, Type 304.

2.06 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify rough window opening dimensions prior to fabrication; indicate field dimensions on shop drawings.

B. Verify that window openings are ready for installation of windows.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

B. Install windows in correct orientation (inside/outside or secure/non-secure).

C. Separate dissimilar metals, and metal members in contact with concrete and masonry, using bituminous paint.

3.03 ADJUSTING

A. Adjust operating components for smooth operation while also providing tight fit at contact points and a secure enclosure; lubricate operating hardware.

3.04 CLEANING AND REPAIR

A. Clean exposed surfaces promptly after installation without damaging finishes.

B. Remove and replace defective work.

END OF SECTION 085619

SECTION 085653
SECURITY WINDOWS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

E. SSPC-Paint 33 - Coal Tar Mastic Coating, Cold-Applied.

F. UL 752 - Standard for Bullet-Resisting Equipment.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Furnish anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, to be embedded into concrete or masonry, with setting diagrams and installation, to applicable installer in time for installation.

B. Preinstallation Meeting: Prior to start of installation arrange a meeting on site to familiarize installer and installers of related work with requirements relating to this work.

1.03 SUBMITTALS

A. Product Data: Manufacturer's published data showing materials, construction details, dimensions of components, and finishes.

B. Shop Drawings: Drawings prepared specifically for this project, showing plans, elevations, sections, details of construction, anchorage to other work, hardware, and glazing.
   1. For existing and in-place openings show verified field dimensions.
   2. Show required opening dimensions and allowance for field deviation.

C. Test Reports: Test reports for specific window model and glazing to be furnished, showing compliance with specified requirements; window and glazing may be tested separately, provided window test sample adequately simulates the glazing to be used.
   1. Include testing agency qualifications.
   2. For structural, forced entry, and ballistic tests, provide details on method of anchorage to test frame.
   3. Reports for thermal requirements may be based on calculations, in accordance with the specified standard.

D. Selection Samples: Color charts for factory finishes.

E. Verification Samples:
   1. Actual sections of frame members, at least 12 inch long, showing finish, weatherstripping, and fasteners.

F. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent testing agency able to show experience in conducting tests of the type specified.

B. Installer Qualifications: Company specializing in performing work of the type specified; certified or approved in writing by security window manufacturer.

C. Welder Qualifications: Qualified in accordance with AWS procedures for type of welding required.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's warranty agreeing to repair or replace windows and window components that fail within three years after Date of Substantial Completion due to, but not limited to, the following:

1. Structural failure, failure of welds, and deterioration of metals and finishes beyond that expected under detention use and normal weathering.
2. Failure of glazing due to excessive deflection of supporting members under wind load.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Security View Windows:

1. Armortex.
2. Chicago Bullet Proof Systems.
3. C. R. Laurence Co., Inc.
4. Creative Industries, Inc.
5. Insulgard Security Products.
6. Krieger Specialty Products.
7. National Bullet Proof, Inc.
8. Norshield Security Products.
9. Overly Door Company.
10. United States Bullet Proofing.
11. Substitutions: See Section 016000 - Product Requirements.

B. Source Limitations: Provide windows from a single manufacturer.

2.02 ASSEMBLIES

A. Security and Detention Windows:

1. Dimensions, profiles, features, and performance specified and indicated on drawings are required; do not deviate unless specifically approved by Architect under substitution procedures; see Section 016000.
2. Design to fit openings indicated on drawings; design to accommodate deviation of actual construction from dimensions indicated on drawings.
3. Fabricate frames and sash with corners mitered or coped full depth with concealed welded joints.
4. Design anchorages to provide performance equivalent to that required for window unit; provide anchorages at least equivalent to those by which the tested units were anchored to the test frame.

5. Separate dissimilar metals to prevent corrosion by galvanic action by painting contact surfaces with primer or with sealant or tape recommended by manufacturer for the purpose.
6. Weld components before finishing and in concealed locations, to greatest extent possible; minimize distortion and discoloration of finish; remove residue of welding; grind exposed welds smooth and finish to match.
7. Label units to indicate which side is which, such as inside/outside or secure/non-secure; use labels that are removable after installation but durable enough not to be lost during delivery, storage, handling, and installation.

2.03 SECURITY VIEW WINDOWS

A. Security View Windows: Factory-assembled fixed glazing panel reglazable from secure side without disassembly of frame, with non-removable trim and glazing stops on non-secure side (outside).
   1. Glazing: Laminated type with glass on surface exposed to weather; kind as required to achieve performance criteria specified.
      a. Total Thickness: 1- to 1-1/4-inches, as standard with manufacturer to meet performance requirements indicated.
      b. Tint: Gray.
      c. Low-E Coating: Provide with low-e coating at exterior window applications to acheive required system thermal performance indicated.
   2. Factory glazed.
   3. Framing and Glazing Stops: Formed aluminum-clad steel sheet; fluoropolymer finish.
      a. Framing Cross Section: 4-1/2-inches deep, with sightline either 2- or 2-1/2-inches, as standard with manufacturer.
   4. Ballistic Resistance: UL 752 Level 3 (super-power handgun).

2.04 ASSEMBLY COMPONENTS

A. Formed Steel Framing: ASTM A1008/A1008M, Designation CS (commercial steel), cold-rolled steel sheet; 12 gauge, 0.1046 inch minimum thickness.

B. Aluminum Framing: ASTM B221 (ASTM B221M) extrusions of alloy and temper selected by manufacturer for strength, corrosion resistance, and finish required; not less that 1/8 inch thick at any location of frame and sash members.

C. Weeps: Include integral weeps for exterior window framing to drain water to the exterior along horizontal framing members.

D. Frame Anchors: Mild steel plates, shapes, or bars, concealed in completed construction; provide anchorage devices as necessary to securely fasten windows to adjacent construction; use security fasteners for exposed anchors.
   1. For Setting in Masonry: Minimum 3/16 inch thick angles or plates, minimum 4 inches long with hooked ends, welded to back of window frame.
   2. Provide minimum of two anchors per side of window plus one additional anchor for each 18 inches or fraction thereof more than 36 inches in height or width.

E. Glazing Seals: Factory installed; molded EPDM or neoprene compressible gaskets and compression strips.

F. Security Fasteners: Operable only by tools produced by fastener manufacturer or manufacturer's licensee; head style appropriate to installation conditions, strength, and finish of materials being fastened; use countersunk heads wherever possible.

G. Deal Trays: Formed stainless steel, recessed into counter or sill for mounting under glazing frame.

1. Style: Plain curved recess welded into counter or sill.
2. Clear Opening Height: 1-1/2 inches.
3. Tray Dimensions: 16 by 11 inches, wide by deep.

H. Bituminous Paint: Cold-applied asbestos-free asphalt mastic, complying with SSPC-Paint 33; 30 mils, 0.030 inch minimum thickness per coat.

I. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.05 FINISHES

A. Fluoropolymer Finish: Cleaned and pretreated; two coat thermosetting finish containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with AAMA 2604; 1.5 to 2 mils thick, applied in accordance with paint manufacturer's recommendations; medium gloss.

B. Color: To be selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that window openings are ready for installation of windows.

B. Verify that correct embedded anchors are in place and in proper location; repair or replace anchors as required to achieve satisfactory installation.

C. Notify Architect if conditions are not suitable for installation of windows; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

B. Install windows in correct orientation (inside/outside or secure/non-secure).

C. Anchor windows securely in manner so as to achieve performance specified.

D. Separate metal members from concrete and masonry using bituminous paint.

E. Separate dissimilar metals, and metal members in contact with concrete and masonry, using bituminous paint.

3.03 ADJUSTING

A. Adjust operating components for smooth operation while also providing tight fit at contact points and a secure enclosure; lubricate operating hardware.

3.04 CLEANING AND REPAIR

A. Clean exposed surfaces promptly after installation without damaging finishes.

B. Remove and replace defective work.

END OF SECTION 085653

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section "Hollow Metal Doors and Frames".
2. Division 08 Section "Flush Wood Doors".
3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 5 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with the Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

1.5 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to project site. Do not store electronic access control hardware, software or accessories at the pproject site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and frames are to be prepared and reinforced for the specified electrified, monitoring, signaling, and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within the specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated below, the warranty shall be one (1) year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors

5. Manufacturers:
a. H. B. Ives (IV) - 5BB1/5BB1HW Series, 5-knuckle.
b. McKinney (MK) - TA/T4A Series, 5-knuckle.
c. Hager Companies (HA) – BB Series, 5-knuckle.

2.3 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:.
a. Hager Companies (HA).
b. Pemko (PE).
c. ABH Manufacturing (AH).

2.4 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. Hager Companies (HA) - ETW-QC (# wires)
    b. McKinney (MK) - QC (# wires)
    c. H. B. Ives)IV) – TW (# wires) Allegion Connect

B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. Pemko (PE) - EL-CEPT Series.
    b. Securitron (SU) - EL-CEPT Series.
    c. Von Duprin (VD) - EPT-10 Series.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools or equivalent as part of the base bid contract:

    a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. Hager Companies (HA) - Quick Connect.
    b. McKinney (MK) - QC-C Series.
    c. Allegion (AL) – Allegion Connect

2.5 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with a top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.

4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. H. B. Ives (IV).
    b. Rockwood (RO).
    c. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

    a. H. B.Ives (IV).
    b. Rockwood (RO).
    c. Trimco (TC).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
6. Manufacturers:

    a. H. B. Ives (IV).
    b. Rockwood (RO).
    c. Trimco (TC).

2.6 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have a minimum of (10) year's experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU). – No Substitutes

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer's Standard.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number.
3. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Three (3).
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys: Ten (10).
4. Construction Control Keys: Two (2).
5. Permanent Control Keys: Two (2).

F. Construction Keying: Provide temporary disposable construction inserts in all cylinders. Supply a total of twenty-five (25) temporary brass cores for securing exterior doors and others as required.

G. Key Registration List (Bitting List):

1. Provide a transcript list in writing or electronic file as directed by the Owner.

2.7 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Electromechanical locksets shall have the following functions and features:

a. Universal Molex plug-in connectors that have standardized color-coded wiring and are available in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by Green Circle.

c. Motorized electric latch retraction where the latchbolt retracts in 0.5 seconds of power being applied; removing power allows the latch to project back to the extended position.
d. Options to be available for request-to-exit or enter signaling, latchbolt and deadbolt monitoring.
e. Optional high security monitoring with internal end-of-line monitoring alongside deadbolt privacy and integrated door position monitoring.
f. Two-year limited warranty on electrified functions.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) - ML2000 Series.
b. Schlage (SC) – L9000 Series.
c. Sargent Manufacturing (SA) - 8200 Series.

2.8 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the push bar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:

    a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
    b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
    c. No catch points: addition of applied deflectors or other added components are not allowed.
    d. No visible plastic.
    e. Heavy duty end caps made of stainless steel, brass, or bronze with architectural finishes.
    f. Stainless steel pullman type latch with deadlock feature.
    g. Narrow or wide style exterior trim as specified in the hardware sets.
    h. Center case adjustability on concealed vertical rod exit devices; single operation with hex key individually adjusts top or bottom latches. No retainer screws or clips required to maintain adjustment.
    i. Ten-year limited warranty for mechanical features.

2. Manufacturers:

    a. Corbin Russwin Hardware (RU) - PED4000 / PED5000 Series.
    b. Sargent Manufacturing (SA) - PE80 Series.
    c. Von Duprin (VD) - 35A/98 XP Series.

C. Steel Removable Mullions: ANSI/BHMA A156.3 steel removable mullions with options for fire rating, locking, through-wire electrification and hurricane compliance as specified.

1. Manufacturers:

a. Same as exit device manufacturer.

2.10 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on the exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Large body cast iron surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:

a. Corbin Russwin Hardware (RU) - DC8000 Series.
b. LCN Closers (LC) - 4040XP Series.
c. Norton Rixson (NO) - 9500 Series.

2.11 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:
    a. H. B. Ives (IV).
    b. Rockwood (RO).
    c. Trimco (TC).

2.12 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. H. B. Ives (IV).
    b. Rockwood (RO).
    c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

    a. ABH Manufacturing (AH).
    b. Norton Rixson (RF).
    c. Sargent Manufacturing (SA).

2.13 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko (PE).
3. Zero International (ZE).

2.14 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.15 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained with at least five years' experience in the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Abbreviations:
1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. RU - Corbin Russwin
6. RF - Rixson

Hardware Sets

Set: 1.0

Doors: 100B

2	Continuous Hinge	CFM__SLF-HD1 PT - DOOR HEIGHT		PE
2	Electric Power Transfer	EL-CEPT	630	SU
1	Mullion	CR9__BKM - DOOR HEIGHT		RU
1	Rim Exit Device, Exit Only	PED5201 M92 M52 EO CT6D	630	RU
1	Rim Exit Device, Exit Only	PED5201 M92 MELR M52 EO CT6D	630	RU
1	Nightlatch Trim	K157ET CT6D	626	RU
4	Interchangeable Core	CR8000	626	RU
1	Cylinder	CR1580 (CAM/LENGTH TO SUIT)	626	RU
2	Pull	RM201 Mtg-Type 1XHD	US32D	RO
2	Surface Closer	DC8210 A11	689	RU
1	Rain Guard	346C		PE
1	Gasketing (Mullion)	5110BL		PE
2	Sweep (w/ drip edge)	3452CNB		PE
1	Threshold	252x3AFG MSES25SS		PE
2	Frame Harness	QC-C1500P		MK
2	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Card Reader	BY SECURITY SUPPLIER		

Notes:
Perimeter/meeting stile seals by frame/door supplier.
Electronic Operation: Valid card at reader or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, the door remains locked and latched (Fail Secure). Card reader, door position switches, and power supply supplied by the access control provider.

Set: 2.0

Doors: 100A

2	Continuous Hinge	CFM__SLF-HD1 - DOOR HEIGHT		PE
1	Mullion	CR9__BKM - DOOR HEIGHT		RU
2	Rim Exit Device, Exit Only	PED5201 M52 EO CT6D	630	RU
1	Nightlatch Trim	K157ET CT6D	626	RU
3	Interchangeable Core	CR8000	626	RU
1	Cylinder	CR1580 (CAM/LENGTH TO SUIT)	626	RU
2	Pull	RM201 Mtg-Type 1XHD	US32D	RO
2	Surface Closer	DC8210 A11	689	RU
1	Rain Guard	346C		PE
1	Gasketing (Mullion)	5110BL		PE
2	Sweep (w/ drip edge)	3452CNB		PE
1	Threshold	252x3AFG MSES25SS		PE

Notes:
Perimeter and meeting stile gasket by door / frame manufacturer. Door is monitored only. Door position switches supplied by the access control provider.

Set: 3.0

Doors: 03-01B

1	Continuous Hinge	CFM__HD1 PT - DOOR HEIGHT		PE
1	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit Device, Exit Only	PED5201 M92 MELR M52 EO CT6D	630	RU
1	Nightlatch Trim	K157ET CT6D	626	RU
2	Interchangeable Core	CR8000	626	RU
1	Pull	RM201 Mtg-Type 1XHD	US32D	RO
1	Surface Closer	DC8210 A11	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Rain Guard	346C		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep (w/ drip edge)	3452CNB		PE
1	Threshold	252x3AFG MSES25SS		PE
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Card Reader	BY SECURITY SUPPLIER		

Notes:
Electronic Operation: Valid card at reader or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, the door remains locked and latched (Fail Secure). Card reader, door position switch, and power supply supplied by the access control provider.

Set: 4.0

Doors: 135B

2	Continuous Hinge	CFM__HD1 - DOOR HEIGHT		PE
1	Mullion	CR9__BKM - DOOR HEIGHT		RU
2	Rim Exit Device, Exit Only	PED5201 M52 EO CT6D	630	RU
1	Nightlatch Trim	K157ET CT6D	626	RU
4	Interchangeable Core	CR8000	626	RU
1	Cylinder	CR1580 (CAM/LENGTH TO SUIT)	626	RU
2	Pull	RM201 Mtg-Type 1XHD	US32D	RO
2	Surface Closer	DC8210 A11	689	RU
2	Kick Plate	K1050 10" CSK	US32D	RO
2	Astragal (Split)	297AS		PE
1	Rain Guard	346C		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Gasketing (Mullion)	5110BL		PE
2	Sweep (w/ drip edge)	3452CNB		PE
1	Threshold	252x3AFG MSES25SS		PE

Notes: Doors are monitored only. Door position switches supplied by the access control provider.

Set: 5.0

Doors: 01-01, 02-01B

1	Continuous Hinge	CFM__HD1 - DOOR HEIGHT		PE
1	Rim Exit Device, Exit Only	PED5201 EO	630	RU
1	Surface Closer	DC8210 A11	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Rain Guard	346C		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep (w/ drip edge)	3452CNB		PE
1	Threshold	252x3AFG MSES25SS		PE

Notes: Doors are monitored only. Door position switch supplied by the access control provider.

Set: 6.0

Doors: 132B

2	Continuous Hinge	CFM__HD1 - DOOR HEIGHT		PE
2	Flush Bolt	555	US26D	RO
1	Storeroom Lock	ML2057 125X CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Surf Overhead Stop	9-X36	630	RF
1	Surface Closer	DC8210 A11	689	RU
2	Kick Plate	K1050 10" CSK	US32D	RO
1	Astragal (Overlapping)	357SP		PE
1	Astragal (Meeting Edge)	S771C		PE
1	Rain Guard	346C		PE
1	Gasketing (Head/Jambs)	S773BL		PE
2	Sweep (w/ drip edge)	3452CNB		PE
1	Threshold	252x3AFG MSES25SS		PE

Notes: Door are monitored only. Door position switches supplied by the access control provider.

Set: 7.0

Doors: 101A, 101B

2	Continuous Hinge	CFM__SLF-HD1 - DOOR HEIGHT		PE
1	Mullion	CR9__BKM - DOOR HEIGHT		RU
2	Rim Exit Device, Exit Only	PED5201 M52 EO CT6D	630	RU
1	Nightlatch Trim	K157ET CT6D	626	RU
3	Interchangeable Core	CR8000	626	RU
1	Cylinder	CR1580 (CAM/LENGTH TO SUIT)	626	RU
2	Pull	RM201 Mtg-Type 1XHD	US32D	RO
2	Surface Closer	DC8210 A11	689	RU
1	Gasketing (Mullion)	5110BL		PE

Notes:
Perimeter and meeting stile gasket by door/frame manufacturer.

Set: 8.0

Doors: 134

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device	PED5257 125957PT CT6D	630	RU
1	Interchangeable Core	CR8000	626	RU
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO

Set: 9.0

Doors: 135A

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device	PED5257 125957PT CT6D	630	RU
1	Interchangeable Core	CR8000	626	RU
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO

Notes: Door is monitored only. Door position switch supplied by the access control provider.

Set: 10.0

Doors: 140, 226

6	Hinge (heavy weight)	T4A3786	US26D	MK
2	Surface Vert Rod Exit	PED5450 A 1259M10PT M55	630	RU
2	Interchangeable Core	CR8000	626	RU
2	Surface Closer	DC8210 A4	689	RU
2	Kick Plate	K1050 10" CSK	US32D	RO
2	Silencer	608		RO

Set: 11.0

Doors: 232B

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device	PED5255 125955PT CT6D	630	RU
1	Interchangeable Core	CR8000	626	RU
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO

Set: 12.0

Doors: 125

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device	PED5255 125955PT CT6D	630	RU
1	Interchangeable Core	CR8000	626	RU
1	Surface Closer	DC8210 A4	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
3	Silencer	608		RO

Set: 13.0

Doors: 02-01A, 02-02, 03-01A, 03-02

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device	PED5210 A 125910PT	630	RU
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/445 (TO SUIT)	US26D	RO
1	Gasketing (Head/Jambs)	S88BL		PE

Set: 14.0

Doors: 106, 107, 112, 116, 117, 120, 124, 133, 205, 220, 221, 232A, 241, 245

2	Hinge (heavy weight)	T4A3786	US26D	MK
1	Electric Hinge (heavy weight)	T4A3786-QC12	US26D	MK
1	Fail Secure Lock	ML20606 x NAC-SEC 125X CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Card Reader	BY SECURITY SUPPLIER		

Notes:
• Electronic Operation: Valid card at reader unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched (Fail Secure). Lock included with door position switch and request to exit.
Card reader, door position switch, and power supply supplied by the access control provider.

Set: 15.0

Doors: 155, 157, 255B, 257

3	Hinge	TA2714	US26D	MK
1	Storeroom Lock	ML2013 M34 CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Surf Overhead Stop	10-X36	US32D	RO
3	Silencer	608		RO

Set: 15.1

Doors: 137, 153, 269

3	Hinge	TA2714	US26D	MK
1	Storeroom Lock	ML2013 M34 CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Door Stop	403	US26D	RO
3	Silencer	608		RO

Set: 16.0

Doors: 111, 136, 139, 144, 208, 214, 218, 230, 233, 244, 264

3	Hinge	TA2714	US26D	MK
1	Storeroom Lock	ML2057 125X CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO

Set: 17.0

Doors: 102B, 105, 109, 145, 146, 209, 210, 211, 212, 213, 247, 248, 265, 266

3	Hinge	TA2714	US26D	MK
1	Entrance Lock	ML2054 125X M34 CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO

Set: 18.0

Doors: 102A

3	Hinge	TA2714	US26D	MK
1	Entrance Lock	ML2054 125X M34 CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Surf Overhead Stop	10-X36	630	RF
3	Silencer	608		RO

Set: 19.0

Doors: 128, 235

3	Hinge	TA2714	US26D	MK
1	Entrance Lock	ML2054 125X M34 CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/445	US26D	RO
3	Silencer	608		RO

Set: 20.0

Doors: 104, 203

6	Hinge	TA2714	US26D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555	US26D	RO
1	Classroom Lock	ML2055 125X CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
2	Kick Plate	K1050 10" CSK	US32D	RO
2	Door Stop	403/445 (TO SUIT)	US26D	RO
2	Silencer	608		RO

Set: 21.0

Doors: 110A, 110B, 113, 129, 141, 142A, 142B, 148, 200A, 200B, 206, 216, 227, 228, 240, 249, 268, 270

3	Hinge	TA2714	US26D	MK
1	Classroom Lock	ML2055 125X CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO

Set: 22.0

Doors: 236

3	Hinge	TA2714	US26D	MK
1	Classroom Lock	ML2055 125X CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Surf Overhead Stop	10-X36	630	RF
3	Silencer	608		RO

Set: 23.0

Doors: 137A, 147, 231A, 234, 267

3	Hinge	TA2714	US26D	MK
1	Classroom Lock	ML2055 125X CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO

Set: 24.0

Doors: 157A, 256

3	Hinge	TA2714	US26D	MK
1	Classroom Lock	ML2055 125X CT6D	626	RU
1	Interchangeable Core	CR8000	626	RU
1	Surface Closer	DC8210 A4	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
3	Silencer	608		RO

Set: 25.0

Doors: 130, 237

3	Hinge	TA2714	US26D	MK
1	Privacy Lock	ML2060 125X M34 V21	626	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Mop Plate	K1050 4" CSK	US32D	RO
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO
1	Coat Hook	RM802	US32D	RO

Set: 26.0

Doors: 114, 115, 121, 126, 165, 204, 215, 217, 224, 242, 243

3	Hinge	TA2714	US26D	MK
1	Privacy Lock	ML2060 125X M34 V21	626	RU
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Mop Plate	K1050 4" CSK	US32D	RO
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO
1	Coat Hook	RM802	US32D	RO

Set: 27.0

Doors: 127

3	Hinge	TA2714	US26D	MK
1	Passage Latch	ML2010 125X	626	RU
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO

Set: 28.0

Doors: 138, 229

6	Hinge (heavy weight)	T4A3786	US26D	MK
2	Door Pull	RM3300-13 Mtg-Type 1	US32D	RO
2	Push Plate	70C	US32D	RO
2	Surface Closer	DC8210 A11	689	RU
2	Kick Plate	K1050 10" CSK	US32D	RO
2	Silencer	608		RO

Set: 29.0

Doors: 122, 123, 222, 223

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Door Pull	RM3300-13 Mtg-Type 1	US32D	RO
1	Push Plate	70C	US32D	RO
1	Surface Closer	DC8200 A10 / DC8210 A3 (TO SUIT)	689	RU
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Mop Plate	K1050 4" CSK	US32D	RO
1	Door Stop	403/445 (TO SUIT)	US26D	RO
3	Silencer	608		RO

Set: 30.0

Doors: 168A, 168B

0	All Hardware	BY DOOR SUPPLIER

END OF SECTION 087100

SECTION 087113
POWER DOOR OPERATORS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. BHMA A156.10 - Power Operated Pedestrian Doors.

C. {RSTEMP#1686}ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.{CH#396325}.

D. NFPA 70 - National Electrical Code.

E. NFPA 101 - Life Safety Code.

F. UL (DIR) - Online Certifications Directory.

G. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate power door operators with balance of door hardware and electrical work required for each affected door opening.

B. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following parties.

1. Architect.
2. Installer's Architectural Hardware Consultant (AHC).
3. Owner's Representative/Security Consultant.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings:

1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.

C. Product Data: Provide data on system components, sizes, features, and finishes.

D. Installer's qualification statement.

E. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for components of power door operators. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Operators for Swinging Doors:
   1. ASSA ABLOY Entrance Solutions; Besam SW200i.
   2. DORMA USA, Inc; ED250.
   3. Horton Automatics; S4100.
   4. record-usa; 8100 Series Swing Door.
   5. Substitutions: See Section 016000 - Product Requirements.

2.02 POWER DOOR OPERATORS - GENERAL

A. Electrically Operated or Controlled Hardware: Provide necessary power supplies, relays, and interfaces as required for proper operation; provide wiring between control components and to building power connection in compliance with NFPA 70.

B. Comply with ADA Standards for egress requirements.

C. Comply with NFPA 101 and requirements of authorities having jurisdiction; provide units selected for actual door weight and for light pedestrian traffic unless otherwise indicated.

D. Exterior and Vestibule Doors: Provide equipment suitable for ambient operating temperature range of minus 20 to plus 140 degrees F.

E. Exterior Doors: Provide units capable of operating, closing, and holding doors closed under positive and negative differential pressure; if necessary, provide power closing.

F. System Integration: Integrate operator functionality with other systems as required for a complete working installation.

2.03 OPERATORS FOR SWINGING DOORS

A. Door Operator:
   1. Applications: Include operators for a single leaf at each double door assembly.
      a. Sequenced Operation: At vestibule locations (both entry and exit sides), door operators shall be sequenced such that activation via actuator shall open first door, followed by a time-delay and second door shall open without occupant needing to activate another actuator within the vestibule. Time-delay shall be set at 3 seconds and shall be field-adjustable.
   2. Speed Control: Variable, field-adjustable opening and closing cycles.
   3. Functionality: Full-power open, spring close operation.
      a. Full-Power Operators: Comply with BHMA A156.10; safeties required.
         1) Comply with UL 325; acceptable evidence of compliance includes UL (DIR) or {\rs\#1} listing or test report by testing agency acceptable to authorities having jurisdiction.
         2) Signage: Provide signage in accordance with BHMA A156.10.
   4. Mounting: Surface mounted overhead.
   5. Components:
      a. Header Case: Manufacturer's standard extruded aluminum profile containing door operator and door mounting components.
      b. Motor and Gearbox Assembly: Manufacturer's standard sealed motor, gearbox, and drive belt.

6. Power Supply Units: Self-contained, electrically operated, and independent of door operator.
7. Actuators: Touchless sensor plate.

2.04 CONTROLLERS, ACTUATORS, AND SAFETY DEVICES

A. Controllers: Manufacturer's standard for products specified.
   1. Provide microprocessor operated controller for each door.
B. Actuators: Manufacturer's standard for products specified and as specified below.
   1. Touchless Wave Plate Actuator/Safety: Microwave; 4-1/2 inch square touchless sensor; distance of control sensitivity adjustable.
C. Safety Devices: Manufacturer's standard units recommended for project applications and conditions.
   1. Swinging Door Safety Device: Door-mounted proximity detector device arranged to prevent operation of door when persons or obstructions are in the swing zone.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify installation conditions including, but not limited to the following: opening sizes, floor conditions, plumb and level mounting surfaces.
B. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.
C. Verify that electric power is available, in the correct location, and of the correct characteristics.

3.02 INSTALLATION

A. Coordinate installation of components with related and adjacent work.
B. Install equipment in accordance with manufacturer's instructions.
C. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.

3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

3.04 CLEANING

A. Remove temporary protection, clean exposed surfaces.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate to Owner's representative equipment operation, operating components, adjustment features, and lubrication requirements.

END OF SECTION 087113

SECTION 088000
GLAZING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

E. ASTM C1036 - Standard Specification for Flat Glass.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

K. GANA (GM) - GANA Glazing Manual.

L. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.

M. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

N. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

O. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.03 SUBMITTALS

A. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

C. Certificate: Certify that products of this section meet or exceed specified requirements.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and IGMA TM-3000 for glazing installation methods.

1.05 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Integrated Exterior Mockups: Provide glazing to match glazing systems required for Project, including glazing installation methods, for incorporation into integrated exterior mockup as indicated on Drawings and as specified in Division 01 "Quality Requirements."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions. Deliver and store in a manner to prevent exposure to weather/moisture, direct sun/UV, and temperature changes.

1.07 FIELD CONDITIONS

A. Ambient Conditions: Do not install glazing, gasketing, or liquid sealants under adverse weather conditions, or when temperatures are above or below manufacturer's recommended limitations for sealant installation.

1. Do not install glazing when ambient temperature is less than 40 degrees F.
2. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:

1. Cardinal Glass Industries.
2. Guardian Glass, LLC.
3. Viracon.
4. Vitro Architectural Glass (formerly PPG Glass).

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Pressure: Calculated in accordance with ASCE 7 and values indicated on Structural Drawings.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.

4. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide complete assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and air barrier.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   3. Provide Type I, Quality-Q3, Class 1 (clear) glazing unless otherwise indicated.
      a. Tinted Glazing: Where tinted glazing is indicated, provide Class 2 (tinted).
   4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
   5. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
   6. Spandrel Glass Type: ASTM C 1048, Type I, Condition - B, Quality - Q3, with performance characteristics matching those of adjacent non-spandrel units.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172. Laminated glass shall be free of foreign substances and air or glass pockets.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class A or 16 CFR 1201 - Category II impact test requirements.
   2. Ionoplast Interlayer: 0.060 inch thick, minimum.
      a. Provide Kuraray Trosifol "SentryGlas Plus" or comparable ionoplast interlayer submitted as a properly formatted substitution request.
      b. Color: Clear.
      c. Interlayer Physical Properties:
         1) Young's Modulus:43 kpsi, when tested in accordance with ASTM D5026.
         2) Tensile Strength: 5.0 kpsi, when tested in accordance with ASTM D638.
         3) Elongation: 400%, when tested in accordance with ASTM D638.
         4) Flex Modulus: 50 kpsi, when tested in accordance with ASTM D790.
         5) Heat Deflection Temperature at 0.46 MPa: 110 degrees F, when tested in accordance with ASTM D648.

2.04 INSULATING GLASS UNITS

A. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

B. Insulating Glass Units: Types as indicated. IGU's shall be pre-assembled in factory of multiple lites, with dehydrated interspace.
   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: Manufacturer's warm-edge technology design.
   a. Spacer Width: As required for specified insulating glass unit.
   b. Spacer Height: Manufacturer's standard.
   c. Products:
      1) H.B. Fuller Construction Products Inc; Kodispace 4SG.
      2) Quanex IG Systems, Inc; Super Spacer TriSeal.
      3) Technoform Glass Insulation; TGI-Spacer.
      4) Substitutions: See Section 016000 - Product Requirements.
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.
   b. Color: Black.
6. Purge interpane space with dry air, hermetically sealed.

2.05 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch 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 I. Continuous by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

D. 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.

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. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 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 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 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.06 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

3.08 GLAZING SCHEDULE

A. Type G1 - Monolithic Interior Vision Glazing:
   1. Applications: Interior glazing unless otherwise indicated.
   2. Glass Type: Fully tempered float glass. Provide with safety glazing labeling.
   3. Tint: Clear.

4. Thickness: 1/4 inch, nominal.
5. Glazing Method: Dry glazing method, gasket glazing.

B. Type G2 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing except where otherwise indicated.
2. Space between lites filled with air.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Gray.
b. Coating: Low-E (passive type), on #2 surface.
c. Coating Products (Low-E; Gray Tinted):
1) Cardinal; ES 25 Pure Grey #2.
2) Guardian; SN 68 Gray.
3) Viracon; #VE3-2M.
4) Vitro; Solarban 60 (2) Solargray.
4. Warm-edge spacer.
5. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
6. Total Thickness: 1 inch.
7. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.30, maximum.
8. Solar Heat Gain Coefficient (SHGC): 0.25, maximum.
9. Glazing Method: Dry glazing method, gasket glazing.
10. Provide with safety glazing labeling.

C. Type G3 - Insulating Glass Units: Spandrel glazing.
1. Applications: Exterior glazing where indicated..
2. Space between lites filled with air.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
b. Coating: Low-E (passive type), on #2 surface.
c. Coating Products (Clear; Low-E):
1) AGC; Energy Select 28.
2) Cardinal; ES 28 #2.
3) Guardian; SNX 62/27.
4) Viracon; #VNE 1-63.
5) Vitro; Solarban 70.
4. Warm-edge spacer.
5. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
a. Tint: Clear.
b. Opacifier: Ceramic frit, on #4 surface.
c. Opacifier Color: Selected by Architect from manufacturer's full range.
6. Total Thickness: 1 inch.
7. Thermal (U-Value and SHGC): Match requirements of vision units.
8. Glazing Method: Dry glazing method, gasket glazing.
9. Provide with safety glazing labeling.

D. Type G4 - Monolithic Laminated Interior Vision Glazing:
1. Applications: Interior glazing, where indicated.

2. Glass Type: Laminated float glass; provide two panes of 6 mm nominal annealed glass with 0.060-inch ionoplast interlayer. Provide with safety glazing labeling.
3. Tint: Clear.
4. Thickness: 1/2 inch, nominal.
5. Glazing Method: Dry glazing method, gasket glazing.

E. Type G5 - Ballistic-Resistant Glazing - Refer to 085653 - Security Windows; factory-glazed windows with security window manufacturer's standard ballistic-resistant glazing.

F. Type G6 - Fire-Protection Rated Glazing - Refer to 088813 - Fire-Rated Glazing.

END OF SECTION 088000

SECTION 088813
FIRE-RATED GLAZING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants.

F. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

G. GANA (GM) - GANA Glazing Manual.

H. GANA (SM) - GANA Sealant Manual.

I. ICC (IBC) - International Building Code.

J. {RSTEMP#1686}

K. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

L. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies.

M. UL (DIR) - Online Certifications Directory.

N. UL 9 - Standard for Fire Tests of Window Assemblies.

O. UL 10B - Standard for Fire Tests of Door Assemblies.

P. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene preinstallation meeting one week before starting work of this section; require attendance by each of affected installers.

1.03 SUBMITTALS

A. Product Data on Glazing Unit Glazing Types: Provide structural, physical, and environmental characteristics, size limitations, special handling and installation requirements.

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

C. Certificate: Certify that products of this section meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with GANA (GM) for glazing installation methods.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

1.05 FIELD CONDITIONS

A. Ambient Conditions: Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during, and 24 hours after installation of glazing compounds.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty for Coated or Laminated Fire Glass: Provide five-year manufacturer warranty coverage for coating deterioration or delamination, including providing products to replace failed units, and commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads and withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Provide glass edge support system sufficiently stiff to limit lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   3. Glass thicknesses listed are minimum.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Kind FT - Fully Tempered Type: Comply with ASTM C1048.
   2. Impact-Resistant Safety Glass: Comply with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.

2.03 GLAZING UNITS

A. Fire-Protection-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve indicated fire rating period(s) as indicated on drawings.
   1. Applications:
      a. Vision lites in fire-rated door assemblies where glazing area does not exceed allowable.
      b. Other locations as indicated on drawings.
   2. Glass Type: Safety ceramic glass.
   3. Provide products listed by {\rs\#2} or UL (DIR) and approved by authorities having jurisdiction.
   4. Safety Glazing Certification: 16 CFR 1201 Category II.
   5. Glazing Method: As required for fire rating.
   6. Fire-Rating Period: As indicated on drawings.
   7. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction

a. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
b. "OH" - meets fire window assembly criteria, including hose stream test of NFPA 257 or UL 9 fire test standards.
c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.
d. "XXX" - placeholder that represents fire-rating period, in minutes.

8. Products:
a. SCHOTT North America Inc; PYRAN Platinum F (Surface-Applied Safety Film).
b. Technical Glass Products; Firelite NT.
c. Vetrotech North America; Keralite/Select Filmed.

2.04 ACCESSORIES

A. Setting Blocks: Aluminum silicate, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch 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. Continuous by one half the height of glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape: Flexible tape made from spun calcium-magnesium-silica fibers in binder; designed to remain stable at temperatures up to 2,012 degrees F.
1. Thickness: As recommended by framing manufacturer for glazing application.

D. Glazing Gaskets: Flexible intumescent seals.

PART 3 EXECUTION

3.01 EXAMINATION

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.

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 referenced glazing 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 contaminating substances that may result from construction operations including, but not limited to weld spatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

A. Application - Interior Glazed: Set glazing infills from interior of building.

B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sightline.

C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

E. Place glazing tape on free perimeter of glazing in same manner described above.

F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

G. Carefully trim protruding tape with knife.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than four days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with '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 088813

SECTION 089100
LOUVERS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

C. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.

D. AMCA 511 - Certified Ratings Program for Air Control Devices.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

1.02 SUBMITTALS

A. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

B. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

C. Samples: Manufacturer's color charts indicating full range of available colors.

D. Test Reports: Independent agency reports showing compliance with specified performance criteria.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.03 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Louvers:

1. Airline Louvers.
2. Airolite Company, LLC.
3. American Warming and Ventilating.
4. Construction Specialties, Inc.
5. Greenheck Fan Corporation.
6. Industrial Louvers, Inc.

7. NCA, a brand of Metal Industries Inc.
8. Pottorff.
9. Reliable Products, Inc.
10. Ruskin.
11. United Enertech.
12. Substitutions: See Section 016000 - Product Requirements.

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511; provide AMCA Certified seal/marking on all louvers.
   1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf without damage or permanent deformation.
   2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
   3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
   4. Screens: Provide insect screens at intake louvers and at non-ducted louvers, and provide bird screens at exhaust louvers.

B. Drainable-Blade Louvers: Horizontal blade, extruded aluminum construction.
   1. Free Area: 50 percent, minimum.
   2. Free Area Velocity at Point of Beginning Water Penetration (0.01 oz. / ft^2): Minimum 1000 fpm.
   3. Intake Pressure Drop at 0.01 oz. / ft^2 free area velocity: 0.20 in. H_2O, maximum.
   4. Blades: Drainable.
   5. Frame: 4 inches deep, channel profile; corner joints mitered, with continuous recessed caulking channel each side.
   6. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.
   7. Aluminum Finish: High performance organic coatings; finished after fabrication.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

2.04 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

B. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.

C. Color: To be selected by Architect from manufacturer's full range .

2.05 ACCESSORIES

A. Blank-Off Panels: Aluminum face and back sheets, polyisocyanurate foam core, 1-1/2 inch thick, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.

B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

C. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch diameter wire, 1/2 inch open weave, diagonal design.

D. Insect Screen: 18 x 16 size aluminum mesh.

E. Fasteners: Concealed type; stainless steel. If exposed fasteners are unavoidable, provide color-matched heads to match framing color.

F. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

G. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Set sill members and sill flashing in continuous bead of sealant.

D. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

E. Secure louver frames in openings with concealed fasteners.

F. Coordinate with installation of mechanical ductwork.

3.03 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION 089100

SECTION 092216
COLD FORMED STEEL FRAMING - NON-STRUCTURAL (CFSF-NS)

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Refer to Section 054000 - Cold-Formed Steel Framing - Structural (CFSF-S): Requirements for structural, load-bearing, metal stud framing and overhead/suspended/bulkhead framing.

1.02 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

1.03 SUBMITTALS

A. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

PART 2 PRODUCTS

2.01 FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: AISI S220; sheet steel, of size and properties necessary for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

1. Steel Thickness (Studs and Runners): Minimum 0.0179-inch (18 mil / 25 gauge) unless otherwise required to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf, and as indicated below:
    a. Provide minimum 0.0329-inch thickness (33 mil / 20 gauge) for all partitions using 3-5/8-inch-deep studs where stud partition height is greater than 12 feet above floor level.
    b. Provide minimum 0.0329-inch (33 mil / 20 gauge - Structural) for high-density board applications, such as ASTM C1178 tile backing panels and ASTM C1629 abuse- or impact-resistant gypsum board, and at door frames.
    c. Provide minimum 0.0329-inch (33 mil / 20 gauge - Structural) for walls receiving heavy wall-hung items or loads, including but not limited to wall cabinets, wall-hung countertops, TV brackets, liquid tanks, folding and fixed seats, grab bars, handrails, exercise equipment, and shelving greater than 9 inches deep and over 3 feet in length.
2. Studs: C-shaped with flat faces.
3. Runners: U-shaped, sized to match studs.

4. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
    a. Minimum Steel Thickness: Provide minimum 0.0329-inch (33 mil / 20 gauge - Structural) for all shaft wall stud applications.
    b. Studs: C-T shaped shaft wall stud profile.
    c. Runners and Jamb Struts: J-shaped with tabs, sized to match studs.
5. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
6. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.

B. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

C. Non-Loadbearing Framing Accessories:
1. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
    a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
2. Bracing and Bridging: ASTM A653/A653M G90 galvanized steel; cold-rolled channel / hat-section profile; for lateral bracing of wall studs with slots for engaging on-module studs.
3. Framing Connectors: ASTM A653/A653M steel clips; secures cold rolled channel to wall studs for lateral bracing.
4. Sheet Metal Backing: 0.036 inch thick flat strap/plate.
5. Fasteners: Self-tapping screws designed for attachment of metal framing and recommended by manufacturer.
6. Anchorage Devices: Powder actuated or screw anchors with sleeves, recommended by manufacturer for anchorage to indicated substrates.
7. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced. Thickness as indicated, or sized to fit stud depth indicated.
8. Acoustic Sealant: Refer to Division 07 Section "Joint Sealants."

2.02 GYPSUM BOARD SUSPENSION SYSTEM

A. For interior overhead gypsum board, in lieu of separate stick built fixed-framing bulkheads and soffits fabricated of Structural Cold-Formed Steel Framing (CFSF-S), Contractor may provide a direct hung suspension system, per ASTM C645, composed of pre-fabricated beams and cross-furring members, specifically designed for use with gypsum board.

B. Products:
1. Armstrong; Quikstix Drywall Grid System.
2. Certainteed; 1-1/2" Drywall Suspension System.
3. Rockfon; Chicago Metallic Drywall Grid System.
4. USG; Drywall Suspension System.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Install in accordance with ASTM C754. Provide framing, including bracing, bridging, and anchorage accessories, to meet L/240 deflection limit at a lateral pressure of 5 psf unless indicated otherwise.

1. Gypsum Board: At gypsum board partitions and assemblies, comply with applicable requirements of ASTM C840 for framing installation.

B. Extend partition framing to deck at locations indicated, and to a height 4 inches above ceiling level at all other locations, unless otherwise indicated.

C. Partitions Terminating to Deck: Secure partitions to building structure in accordance with Structural Drawings. Do not fasten runner directly to floor/roof deck; provide clearance for firestopping. Coordinate with Section 078400 - Firestopping for head-of-wall joint firestopping assemblies and firestopping around structural elements as required.

D. Partitions Terminating Above Ceiling: Attach studs to runner using specified mechanical devices in accordance with manufacturer's instructions. Brace runners to structural elements in accordance with Structural Drawings.

E. Align and secure top and bottom runners at maximum 24 inches on center.

F. At partitions indicated with an acoustic rating:

1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.

G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

H. Install studs vertically at 16 inches on center, unless otherwise indicated.

I. Align stud web openings horizontally.

J. Secure studs to tracks using crimping method. Do not weld.

K. Fabricate corners using a minimum of three studs.

L. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

M. Install bracing, bridging, and anchorage to brace stud framing system rigid.

N. Coordinate erection of studs with requirements of door frames; install supports and attachments.

O. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

P. Blocking: Use FRT wood blocking or metal channel stud blocking, secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, opening frames, and other built-in-place wall mounted items and equipment.

Q. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

3.03 GYPSUM BOARD SUSPENSION SYSTEM

A. Install suspension system in accordance with manufacturer's instructions. Do not attach overhead suspension hangers to or suspend from steel floor or roof deck; fasten to primary structural beams/joists or provide intermediate slotted track as supplemental structure between primary structural elements.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION 092216

SECTION 092900
GYPSUM BOARD

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

J. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.

K. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units.

L. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

M. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

N. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels.

O. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

P. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

Q. GA-216 - Application and Finishing of Gypsum Panel Products.

R. UL 752 - Standard for Bullet-Resisting Equipment.

1.02 SUBMITTALS

A. Product Data:
   1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.

B. Ballistic Test Reports: Indicate compliance of bullet-resistant sheathing and wallboard assemblies with specified requirements.

1.03 DELIVERY, STORAGE, HANDLING, AND FIELD CONDITIONS

A. Do not deliver or install until building is weather-tight and conditioned.

B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent damage and to prevent marring and soiling of finished surfaces.

C. Do not install gypsum products that have gotten wet or moldy, or show signs of past moisture damage.

D. Maintain uniform temperature and humidity at occupancy conditions during and after installation. Allow products to acclimatize prior to installation.

PART 2 PRODUCTS

2.01 BOARD MATERIALS

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; with tapered edges.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold-resistant board is required whenever gypsum board is indicated in rooms subject to steam or water, including mechanical rooms, toilet rooms, custodial rooms, and kitchens.
   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. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.
      c. Curved Surfaces: Provide flexible 1/4 inch thickness gypsum board, installed in two layers.

B. Impact Resistant Wallboard:
   1. Application: High-traffic areas indicated.
   2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   5. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   7. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
   8. Glass Mat-Faced Type: Gypsum wallboard, as defined in ASTM C1658/C1658M.
   9. Type: Fire-resistance-rated Type X, UL or WH listed.
   10. Thickness: 5/8 inch.
   11. Edges: Tapered.
   12. Paper-Faced Products:
      a. American Gypsum Company; M-Bloc IR Type X.
      b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech.
      c. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board.
      d. Substitutions: See Section 016000 - Product Requirements.
   13. Glass Mat Faced Products:
      a. Georgia-Pacific Gypsum; DensArmor Plus Impact-Resistant.

b. USG Corporation; USG Sheetrock Brand Glass-Mat Panels Mold Tough VHI.
c. Substitutions: See Section 016000 - Product Requirements.

C. Tile Backing Board:
1. Application: Surfaces behind tile in wet areas including tub and shower surrounds.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. ANSI Cement-Based Board: Non-gypsum-based; cementitious panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 and ASTM C 1288 or ASTM C1325.
a. Thickness: 5/8 inch.
b. Available Products:
1) FinPan, Inc.; Util-A-Crete Backer Board.
2) National Gypsum Company; PermaBase Cement Board.
3) USG Corporation; Durock Cement Board.
4) Substitutions: See Section 016000 - Product Requirements.

D. Bullet Resistant Sheathing and Wallboard: Woven roving, multi-ply, ballistic grade fiberglass cloth with thermoset polyester resin; comply with UL 752 Level 3. Size boards to minimize joints.
1. Thickness: Nominal 7/16 inch or 1/2 inch as standard with manufacturer.
2. Available Products:
a. ArmorCore by Waco Composites; Bullet Resistant Fiberglass Panels.
b. Armortex, Div. of Safeguard Security System, Inc.; OF 300.
c. Chicago Bullet Proof Systems; Fibre-Tex.
d. C.R. Laurence of North America; BRF300.
e. Insulgard Corporation; FG-300.

E. Exterior Sheathing Board for Ceilings and Soffits: Sizes to minimize joints in place; ends square cut.
1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
2. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
4. Edges: Square.
5. Available Glass Mat Faced Products:
a. American Gypsum Company; M-Glass Exterior Sheathing.
b. CertainTeed Corporation; GlasRoc Exterior Sheathing.
c. Georgia-Pacific Gypsum; DensGlass Sheathing.
d. National Gypsum Company; Gold Bond eXP Sheathing.
e. USG Corporation; USG Securock Brand Ultralight Glass-Mat Sheathing.

F. Shaftwall Liner Panels: Type X; 1 inch thick, square long edges, ends square cut.
1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.02 GYPSUM BOARD ACCESSORIES

A. Sound Attenuation Batts: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness sized to fit metal stud cavity.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant. Refer to sealant AS-1 in Division 07 Section "Joint Sealants."

C. Putty Pads: Non-hardening endothermic material, in pad form, faced on both sides with poly liner, designed to seal around penetrations and wiring devices, enhancing acoustic performance.
   1. Nominal Size: 7-1/4 x 7-1/4 x 3/16 inches.
   2. Available Products:
      a. 3M; Fire Barrier Moldable Putty Pads MPP+.
      b. Hilti; Firestop Putty Pad, CFS-P PA.
      c. Specified Technologies, Inc.; SpecSeal Putty Pad.

D. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Corner Beads: Low profile, for 90 degree outside corners.
   2. L-Bead, LC-Bead, and U-Bead: Sized to fit gypsum wallboard size(s) indicated.
      a. Provide LC-bead at exposed panel edges and U-bead at concealed panel edges, unless otherwise indicated. Provide L-bead at locations indicated.

E. Decorative Metal Trim:
   1. Material: Extruded aluminum alloy 6063-T5 temper.
   2. Finish: Anodized, clear.
   3. Type: Profile(s) as indicated on Drawings; selected from manufacturer's standard range.
   4. Reveal Trim: Provide 1/2-inch wide by either 1/2-inch or 5/8-inch deep, as standard with manufacturer.
      a. Products:
         1) Fry Reglet; Model DRM-625-50.
         2) Flannery, Inc; Model DWR 625-50.
         3) Gordon, Inc; Part # 512-5/8.
         4) Pittcon Industries; Model SWR-050-063.
         5) Tamlyn; Model RV5-12.
   5. "F" Reveal Molding: 1/2-inch wide by 5/8-inch deep with 7/8-inch flange on one side only for reveals where drywall terminates against jamb, ceiling, or other finish material.
      a. Products:
         1) Fry Reglet; Model DRMF-625-50.
         2) Flannery, Inc; Model DWRF 625-50.
         3) Gordon, Inc; Part # 412-5/8.
         4) Pittcon Industries; Model SWR-050U-063.
         5) Tamlyn; Model MCR5-12
   6. L-Trim Molding: "L" angle molding where drywall raised panel terminates at other substrates.
      a. Products:
         1) Fry Reglet: Model DRML-625.
         2) Flannery, Inc; Model DWL 625.
         3) Gordon, Inc; Part # 258.
         4) Pittcon Industries; Model ST-063.
         5) Tamlyn; Model MLR-58.
   7. Stepped Outside Corner: Exposed metal reveal profile for 90 degree outside corners.

a. Products:
1) Fry Reglet: Model DRMW 625-625.
2) Flannery, Inc; Model DWRW 625-625.
3) Gordon, Inc; Part # 945-2X-58.
4) Pittcon Industries; Model SCS-2X 063-063.
5) Tamlyn; (no product - provide custom to match profiles above).

F. Metal Edge Trim for "Cloud" Suspended Ceilings: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for a complete trim system.
1. Trim Height: 4 inches.
2. Finish: Baked enamel; white.
3. Available Products:
a. Armstrong World Industries, Inc.; Axiom Classic.
b. Certainteed; Terminus Perimeter Trim.
c. Chicago Metallic Corp.; Infinity System.
d. USG Corporation; Compasso Suspension Trim.

G. Acoustic Partition Closure at Storefront or Curtain Wall: Multi-piece rectangular-section assembly of nested U-shape aluminum extrusions for finished closure between aluminum storefront or curtainwall system vertical mullion (and glass where indicated), and partition assembly. Closure shall allow for movements of framing and glass it attaches to, and shall not allow direct metal to glass contact. Fill cavity of partition closure with acoustic batt insulation.
1. Thickness: Aluminum closure plates not less than 0.125-inch thick.
2. Acoustic Rating: Provide product with a minimum tested STC rating of 55.
a. Acoustic Material: Fungi- and microbe-resistant foam, Class A rated when tester per ASTM E 84.
3. Acoustical Sealant: Seal both ends of partition closure with acoustical sealant.
4. Finish: Powder coat; color selected by Architect from manufacturer's full range.
5. Available Products:
a. Gordon, Inc; Mullion Mate.
b. Mull-It-Over Products; Mull-It-Over.

H. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

I. Exterior Soffit Vents: One piece, perforated, ASTM B221 6063 T5 alloy aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.
1. Available Manufacturers:
a. Fry Reglet.
b. Gordon, Inc.
c. Pittcon Industries.
d. Stockton Products.
2. Flat, horizontal-to-horizontal application: 2-inch wide with three rows of vent slots for a minimum of 3 square inches of opening per linear foot.
3. Finish: High performance organic coating; color selected by Architect from manufacturer's full range.

J. Security Barrier Mesh: ASTM F 1267, Type II, Class 1; expanded and flattened diamond mesh security barrier. Fabricate of uncoated, minimum 18 gage carbon steel, weight 0.66 lbs/sq. ft. Provide with lath mesh size approximately 1/2-inch by 1-1/4-inch.

1. Mesh Fasteners: Provide fasteners that are non-corrosive to both mesh and framing substrate; as recommended by manufacturer for mesh-to-mesh and mesh-to-framing fastening.

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 manufacturer's installation instructions.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Sound Attenuation Batts: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Security Gypsum Partitions and Ceilings: At security gypsum assemblies indicated, install expanded/flattened metal security barrier mesh followed by impact resistant gypsum board.

F. Install gypsum board with an open horizontal joint (gap) not to exceed 5/8-inch above finished floor slab, and tape and finish vertical joints to bottom edge of board to afford a smooth substrate for applied wall base.

G. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

H. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

I. Bullet Resistant Sheathing and Wallboard:
   1. Install bullet-resistant sheathing according to manufacturer's written recommendations and with manufacturer-approved fasteners.
   2. Cover all joints between boards with a 4-inch strip of the same thickness material as the boards, centered on the joint.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints in compliance with ASTM C 840, consistent with lines of building spaces, and as indicated.

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

D. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

E. Putty Pads: Install putty pads on the backside of items penetrating gypsum board on STC-rated walls/partitions. Items include, but are not limited to, wiring devices, cable, conduit, and pipe. Completely cover and seal around each penetration.

3.06 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch.

C. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 092900

SECTION 093000
TILING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.

B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.

C. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.

D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive.

F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy.

H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.

I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.

J. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.

K. 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.

L. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs.

M. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive.

N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar.

O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation.

P. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.

Q. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.

R. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar.

S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.

T. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting at the Project Site one week before starting work of this section; require attendance by affected installers.
   1. Review substrate preparation requirements.
   2. Review each type of tile, mortar, grout, and TCNA installation methods.
   3. Review requirements for waterproofing and/or crack isolation membrane(s).

1.03 SUBMITTALS

A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
   1. Include waterproofing details at floor drains, shower pans, cove base, and thresholds.

C. Installer's Qualification Statement.
   1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
   2. Submit documentation of completion of apprenticeship and certification programs.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall have documented experience of work similar in scope, materials, and design to that indicated for this Project, with a record of successful in-service performance, with references upon request. Installer shall hold company-wide accreditation or employ individuals with one of the listed certifications (comply with at least one):
   1. Company-wide accreditation from one of the following:
      a. Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).
   2. Installer Certification:
      a. Ceramic Tile Education Foundation (CTEF): Certified Tile Installer (CTI).
      b. Apprenticeship Program: Installer has achieved Journeyworker status through an apprenticeship from the International Union of Bricklayers and Allied Craftworkers (IUBAC) or a U.S. Department of Labor (DOL)-recognized program.

1.05 MOCK-UPS

A. See Section 014000 - Quality Requirements for general requirements for mock-up.

B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
   1. Provide mock-up of minimum 5 square feet for each type of floor tile, unless otherwise indicated.
   2. Provide mock-up of minimum 5 square feet for each type of wall tile, unless otherwise indicated.
   3. Approved mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store tile, grout, and mortar off the ground, protected from weather and water infiltration.

B. Store products in unopened containers or packages until ready for use.

C. Protect materials 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 and humidity at levels required by referenced ANSI and TCNA tile standards, and per manufacturer's instructions.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products of each type by the same manufacturer.

B. Porcelain Tile, Type P-TILE-A: ANSI A137.1 standard grade. Color Body Porcelain.
   1. Size: 12 by 24 inch, nominal.
   2. Thickness: 9 mm.
   3. Edges: Rectified.
   4. Color(s): To be selected by Architect from manufacturer's full range.
   5. Trim Units: Matching bullnose, cove base, and cove shapes in sizes coordinated with field tile.
   6. Products:
      a. American Olean; a division of Dal-Tile Corporation.
      b. Dal-Tile Corporation.
      c. Substitutions: See Section 016000 - Product Requirements.

C. Porcelain Tile, Type P-TILE-B: ANSI A137.1 standard grade. Glazed Porcelain Mosaic.
   1. Size: TBD nominal.
   2. Thickness: 9 mm.
   3. Edges: Pressed..
   4. Color(s): To be selected by Architect from manufacturer's full range.
   5. Products:
      a. American Olean; a division of Dal-Tile Corporation.
      b. Dal-Tile Corporation.
      c. Substitutions: See Section 016000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile.
      b. Open edges of floor tile.
      c. Wall corners, outside and inside.
      d. Transition between floor finishes of different heights.
      e. Thresholds at door openings.
      f. Expansion and control joints, floor and wall.
      g. Floor to wall joints.
      h. Borders and other trim as indicated on drawings.

2. Manufacturers:
    a. Schluter-Systems.
    b. Genesis APS International.
    c. Blanke.
    d. Ceramic Tool Company (CTC).
    e. Substitutions: See Section 016000 - Product Requirements.

B. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
    1. Material: Marble, honed finish.
    2. Applications:
        a. At doorways where tile terminates.

2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
    1. Applications: Use this type at all locations where thinset mortar is indicated, unless otherwise indicated.
    2. Products:
        a. Custom Building Products; VersaBond Professional Thin-Set Mortar.
        b. H.B. Fuller Construction Products, Inc.; TEC Full Flex TA 390/391.
        c. LATICRETE International, Inc.; 252 Silver.
        d. MAPEI Corporation; Ultraflex 2.
        e. Summitville Tiles, Inc.; S-1000 MP Thin-Set Latex Mortar.
        f. Substitutions: See Section 016000 - Product Requirements.

C. Latex-Portland Cement LHT Mortar (Medium-Bed): ANSI A118.4.
    1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated, in a 1/4- to 3/8-inch thick medium-bed application.
    2. Products:
        a. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer.
        b. H.B. Fuller Construction Products, Inc; TEC Ultimate Large Tile Mortar.
        c. LATICRETE International, Inc; 257 TITANIUM.
        d. MAPEI Corporation; Ultraflex LFT.
        e. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex.
        f. Summitville Tiles, Inc.; S-1200 MP Premium Medium Bed Mortar.
        g. Substitutions: See Section 016000 - Product Requirements.

2.04 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
    1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
    2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
    3. Color(s): To be selected by Architect from manufacturer's full range.
    4. Products:

a. Custom Building Products; Prism Color Consistent Grout.
b. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout.
c. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout.
d. MAPEI Corporation; Ultracolor Plus.
e. Merkrete, by Parex USA, Inc; Merkrete Pro Grout.
f. Substitutions: See Section 016000 - Product Requirements.

C. Water-Cleanable Epoxy Grout: ANSI A118.3 stain-resistant epoxy grout.
1. Applications: Where indicated.
2. Heat Resistance: Tested by manufacturer for continuous exposure up to 140 deg F, and intermittent exposure up to 212 deg F.
3. Color(s): To be selected by Architect from manufacturer's full range.
4. Products:
a. Custom Building Products; CEG-Lite 100% Solids Commercial Epoxy Grout.
b. H.B. Fuller Construction Products, Inc; TEC AccuColor EFX Epoxy Special Effects Grout.
c. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout.
d. MAPEI Corporation; Kerapoxy CQ.
e. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy.
f. Summitville Tiles, Inc; S-500 Ultra Max.
g. Substitutions: See Section 016000 - Product Requirements.

2.05 MAINTENANCE MATERIALS

A. Tile Sealants: Moisture- and mildew-resistant type sealants; one-part silicone for wall applications and multi-part urethane for floor applications. Sealants and accessories shall comply with requirements below and with requirements of Division 7 Section "Joint Sealants."
1. Color(s): As selected by Architect from manufacturer's full line. Sealant colors shall match grout colors in adjacent joints unless otherwise indicated.
2. Silicone Sealant (Walls): ASTM C 920, Type S, Grade NS, Class 25; Uses NT (non-traffic), G (glass), A (aluminum), O (other substrates indicated).
a. Products:
1) GE Silicones, a division of GE Specialty Materials; SCS1700 Sanitary.
2) Pecora Corporation; Pecora 898 NST.
3) Tremco Inc.; Tremsil 200.
4) Substitutions: See Section 016000 - Product Requirements.
3. Urethane Sealant (Floors): ASTM C 920, Type M, Grade P, Class 25; Uses T (traffic), M (mortar), A (aluminum), O (other substrates indicated).
a. Products:
1) Master Builders Solutions; MasterSeal SL 2.
2) Pecora Corporation; NR-200 Urexpan.
3) Sika Corporation; Sikaflex-2c SL.
4) Tremco Inc.; THC-901.
5) Substitutions: See Section 016000 - Product Requirements.
4. Sealant Accessories: Provide backer rod, primer, and other sealant accessories as recommended by sealant manufacturer for applications required.

B. Grout Sealer: Liquid-applied, penetrating, moisture and stain protection for existing or new Portland cement grout.

1. Composition: Water-based colorless silicone.
2. Products:
   a. Custom Building Products; Aqua Mix Sealer's Choice Gold.
   b. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer.
   c. SGM, Inc.; Grout Sealer.
   d. Summitville Tiles, Inc.; SL-99 Summitseal II.
   e. Substitutions: See Section 016000 - Product Requirements.

C. Tile Sealer: Stain protection for exposed surfaces of unglazed ceramic tile, other porous tile, and grout. Provide penetrating sealer with no sheen, preserving natural tile appearance.
   1. Products:
      a. Custom Building Products; Aqua Mix Sealer's Choice Gold.
      b. Rust-Oleum Corporation; Miracle Sealants 511 Impregnator Natural Looking Penetrating Sealer.
      c. STONETECH, a division of LATICRETE international, Inc; STONETECH Heavy Duty Sealer.
      d. Substitutions: See Section 016000 - Product Requirements.

D. Grout Release: Temporary, water-soluble pre-grout coating.
   1. Products:
      a. Custom Building Products; Aqua Mix Grout Release.
      b. MAPEI Corporation; UltraCare Grout Release.
      c. Substitutions: See Section 016000 - Product Requirements.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/8 inch gap, minimum.
   2. Peel-and-Stick Sheet Type:
      a. Material: Rubberized membrane laminated to reinforcing fabric.
      b. Thickness: 40 mils, nominal.
      c. Products:
         1) Boiardi Products Corp.; a QEP company; Elastiment 340 Sound Control Sheet Membrane Waterproofing and Anti-Fracture/Crack-Suppression System.
         2) Custom Building Products; Crack Buster Pro-Crack Prevention Mat Underlayment.
         3) MAPEI Corporation; Mapeguard 2.
         4) National Applied Construction Products, Inc.; ECB Anti-Fracture Membrane.
         5) Substitutions: See Section 016000 - Product Requirements.

B. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Crack Resistance: No failure at 1/8 inch gap, minimum; comply with ANSI A118.12.
   2. Fluid or Trowel Applied Type with Embedded Reinforcing Fabric:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: 30 mils, minimum, dry film thickness.
      c. Products:
         1) Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.

2) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane.
3) LATICRETE International, Inc; 9235 Waterproofing Membrane.
4) MAPEI Corporation; Mapelastic AquaDefense.
5) Merkrete, by Parex USA, Inc; Merkrete Hydro Guard 2000.
6) Summitville Tiles, Inc.; S-9000.
7) Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work, per ANSI A108.01, and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive 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. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. For ease of cleaning and to prevent staining, precoat tile with temporary grout release. For unglazed ceramic and other porous tile types, provide either combination tile sealer/grout release, or a temporary grout release with final tile sealer applied after tile installation.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor 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. Install thresholds where indicated.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F122/F122A, over combination waterproofing/crack-isolation membrane, with latex-Portland cement grout.
   1. Provide modified dry-set mortar in a standard thinset bed, except provide LHT mortar in a 1/4- to 3/8-inch medium bed at all large format tile (tile 12 inches or greater in any dimension).

3.05 INSTALLATION - WALL TILE

A. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION 093000

SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E. 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.

F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

1.02 SUBMITTALS

A. Shop Drawings Required: Indicate grid layout and related dimensioning.

B. Product Data: Provide data on suspension system components, acoustical units, and specialty ceiling products as indicated.

C. Selection Samples: Manufacturer's color charts or other printed data, indicating full range of textures and finishes available for ACP-B and ACP-C only.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Panels: Quantity equal to 2 percent of total installed, of each type.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

A. Source Limitations: Provide each acoustical ceiling assembly (ceiling panel and suspension system) from a single manufacturer to obtain manufacturer's system warranty.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver until building is weather-tight and conditioned.

B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent damage and to prevent marring and soiling of finished surfaces.

1.05 FIELD CONDITIONS

A. Maintain uniform temperature and humidity at occupancy conditions during and after acoustical unit installation. Allow products to acclimatize prior to installation.

1.06 WARRANTY

A. System Warranty: Provide a single source system warranty covering both acoustical ceiling panels and suspension system.
   1. Warranty shall cover material failures including sag, warping, shrinkage, or delamination, biologic growth including mold or mildew, and rusting of suspension system.
   2. Warranty Period: Minimum 15 years, from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Each acoustical ceiling shall be Class A rated, with flame spread index of 25 or less, smoke developed index of 50 or less, when tested in accordance with ASTM E84.

B. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7, which references applicable requirements ofASTM E580/E580M "Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Subject to Earthquake Ground Motions." for Seismic Design Category indicated on Structural Drawings and complying with local authorities having jurisdiction.

2.02 ACOUSTICAL PANELS

A. Acoustical Panels - General: ASTM E1264, Class A.
   1. Antibacterial/Antimicrobial Treatment: Provide acoustical panels that have been factory-treated by manufacturer for resistance to bacteria, mold, mildew, and fungus.
   2. Humidity/Sag Treatment: Provide acoustical panels that have been factory-treated by manufacturer for humidity and sag-resistance.

B. Acoustical Panels ACP: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264, Type IV.
      a. Form: 2, water felted.
   2. Size: 24 by 24 inches.
   3. Thickness: 1 inches.
   4. Light Reflectance: Not less than 0.80, determined in accordance with ASTM E1264.
   5. NRC Range: Not less than 0.55, determined in accordance with ASTM E1264.
   6. Panel Edge: Square.
   7. Tile Edge: Square Tegular.
      a. Joint: Kerfed and rabbeted.
   8. Color: White.
   9. Suspension System: Exposed grid.
   10. Products:
      a. Armstrong World Industries, Inc; Calla - Item #2822.
      b. CertainTeed.
      c. USG Corporation; Mars High NRC - Item #88135.
      d. Substitutions: See Section 016000 - Product Requirements.

C. Acoustical Panels ACP-B: PET felt grille acoustical panel, with the following characteristics:
   1. Fire Rating: ASTM E-84, Class A
   2. Size: 24"x48" Tee Grid system
   3. NRC Range: Not less than 0.75, determined in accordance with ASTM E1264.
   4. Color: As selected from manufacturer's full range.
   5. Suspension System: Exposed grid.
   6. Products:
      a. Turf; Scapes - Grille. (Basis of Design)
      b. Armstrong Ceilings; "Lyra PB" Wood Look
      c. Unika Vaev; "Ecoustic Blade Ceiling Tile"

d. Substitutions: See Section 016000 - Product Requirements.

D. Acoustical Panels ACP-C: PET felt grille acoustical panel, with the following characteristics:
1. Fire Rating: ASTM E-84, Class A
2. Size: 2"x2" blades, 4" OC spacing
3. NRC Range: Not less than 0.75, determined in accordance with ASTM E1264.
4. Color: As selected from manufacturer's full range.
5. Suspension System: 15/16" Tee Grid
6. Products:
a. Turf; Scapes - Arbor. (Basis of Design)
b. Armstrong Ceilings; "Lyra PB" Wood Look
c. Unika Vaev
d. Substitutions: See Section 016000 - Product Requirements.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
1. Materials:
a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
2. Cross Tee/Main Runner Connection: Override (stepped).
3. Main Runner End Coupling: Bayonet ("stab") type; knuckle type is not acceptable.

B. Exposed Suspension System, Type ACP-A: Hot-dipped galvanized steel grid and cap.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16 inch face width.
3. Finish: Baked enamel.
4. Products:
a. Armstrong World Industries, Inc; Prelude XL 15/16".
b. CertainTeed Ceilings, Inc; 15/16" EZ Stab Classic System.
c. USG Corporation; Donn Brand DX/DXL 15/16 inch Acoustical Suspension System.
d. Substitutions: See Section 016000 - Product Requirements.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
1. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.

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 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install in bed of acoustical sealant.
   2. Use longest practical lengths.
   3. Overlap and rivet corners.

D. 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.
   1. Do not hang suspension system directly from steel floor or roof deck.

E. 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.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

3.04 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.

F. Where round obstructions and bullnose concrete block corners occur, provide preformed closures to match perimeter molding.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION 095100

SECTION 095753
SECURITY CEILING ASSEMBLIES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E. 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.

F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel.

H. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

1.02 DESIGN REQUIREMENTS

A. Design components to ensure light fixtures will not induce eccentric loads. Where components may induce rotation of ceiling system components, provide stabilizing reinforcement.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.

B. Preinstallation Meeting: Convene one week before starting work of this section.

C. Sequencing: Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.

1.04 SUBMITTALS

A. Product Data: Furnish for component profiles, materials, and perimeter and integral trim.

B. Shop Drawings: Indicate reflected ceiling plan.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Designer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform 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. Installer Qualifications: Company specializing in performing the work of this section.

1. Approved by metal ceiling manufacturer.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1 (Steel) and D1.3 (Sheet Steel), and dated no more than 12 months before start of scheduled welding work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.

B. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry, conditioned storage area.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Security Plank Ceilings (Single-Layer Panels) (SC-PLK):
   1. Armstrong World Industries, Inc.; Metalworks SecureLock Plus.
   2. Eckel Industries, Inc.; Eckoustic Security Ceiling.
   3. Gordon Corrections Division; Celline Suspended Metal Security Plank Ceiling System.
   4. Luxalon Architectural Products, div. of Hunter Douglas; Luxalon Heavy Duty Limited Access Planks.
   5. Steel Ceilings, Inc.; Metal Plank Security Ceiling System.
   6. Trussbilt, Inc.; BarrierDek Security Plank Ceiling System.
   7. Substitutions: See Section 016000 - Product Requirements.

B. Security Grid Ceilings (2' x 2' Downward-Locking Security Tile) (SC-PNL):
   1. Armstrong World Industries, Inc.; Metalworks SecureLock.
   2. Gordon Corrections Division; Lockdown Suspended Metal Panel Ceiling System.
   3. Luxalon Architectural Products, div. of Hunter Douglas; Luxalon Lay-In Self-Locking Limited Access Ceiling.
   4. Steel Ceilings, Inc.; Defender Security Panels.
   5. Trussbilt, Inc.; SecureDek Metal Pan Ceiling System.
   6. Substitutions: See Section 016000 - Product Requirements.

2.02 SECURITY CEILING ASSEMBLIES

A. Security Ceiling Assembly: Ceiling panels, suspension members, trim, and accessories as required to provide a complete system.

B. Performance Requirements:
   1. Design to support imposed loads of indicated items without eccentric loading of supports.
   2. Design for maximum deflection of 1/360 of span.
   3. Surface Burning Characteristics: Class A, flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   4. Noise Reduction Coefficient (NRC): 0.80 minimum, measured in accordance with ASTM C423 with insulation installed.

2.03 COMPONENTS

A. Security-Plank Metal Ceilings:
   1. Type (SC-PLK): Linear panel, butt jointed; snap-in installation.

a. Size and Configuration: 18-inch wide panels, configuration as indicated on drawings.

2. Type (SC-PNL): Square panel, lay-in installation with downward-locking attachment.
   a. Size and Configuration: 24- by 24-inch square panels, configuration as indicated on Drawings.
3. Material: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS) or Forming Steel (FS), with AZ60/AZM180 coating; provide with manufacturer's standard continuous white powder-coated finish.
   a. Thickness: 16 gauge; 0.053 inch minimum.
   b. Provide manufacturer's standard perforation pattern with acoustic insulation as required to meet acoustic performance requirements.

B. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.

C. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.

D. Access Panels: Provide of same material, perforations, and finish as security ceiling, with security/detention grade heavy-duty locking system, keyed to building master keying.
   1. For plank type panels, provide access panels matching width of plank, by 24 inches long.
   2. For grid-type panels, provide access panels matching single panel size.

E. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application and ceiling system flatness requirement specified.
   1. Provide perimeter steel channel-type sections for mounting to wall; finished to match exposed suspension members.

F. Suspension Wire: Size and type as required for application and ceiling system flatness requirement specified.

G. Insulation: ASTM C 553, preformed mineral fiber. Thickness as required for acoustical performance indicated.

2.04 FABRICATION

A. Shop cut linear panels to accommodate mechanical and electrical items.

B. Factory-form internal and external corners of same material, thickness, finish, and profile to match exposed linear panels; back brace internal corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Suspension Components:
   1. Install after above-ceiling work is complete in accordance with manufacturer's instructions, ASTM C636/C636M, and ASTM E580/E580M.
   2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels

with adjacent panels.

3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.
4. Locate suspension system for linear panel layout on room axis according to reflected plan.

B. Linear Metal Ceiling:
1. Install linear panels and other system components in accordance with manufacturer's instructions.
2. Provide in continuous single lengths to greatest extent possible. Where end joints are required, stagger end joints minimum 12 inches.
3. Butt interior end joints tight.
4. Install security edge moldings at junctions with other finishes and at vertical surfaces; use maximum piece lengths.
5. Where bullnose masonry units occur, install radiused closures to fit edge molding.

C. Insulation: Install above panel members; fit tight between grid members; place insulation with facing side down.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

C. Maximum Variation From Dimensioned Position: 1/4 inch.

3.04 CLEANING

A. Clean polished surfaces.

B. Replace damaged or abraded components.

END OF SECTION 095753

SECTION 096513
RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.

D. ASTM F1861 - Standard Specification for Resilient Wall Base.

E. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

F. ASTM F2169 - Standard Specification for Resilient Stair Treads.

G. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

H. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.02 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

B. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

C. Protect roll materials from damage by storing on end.

1.04 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 to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

B. Maintain conditions at occupancy conditions for installation and until Substantial Completion.

PART 2 PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic; Style B, Cove.
   1. Products (Type TP):
      a. Armstrong World Industries, Inc.; Rubber Coved Toe Wall Base.
      b. Flexco (USA), Inc.; Flexco Base 2000 - Cove.
      c. Johnsonite, a Tarkett Company; Rubber Wall Base - Cove.
      d. Mannington Commercial; Burkebase Type TP - Coved.

e. Nora Systems, Inc; nora wall base; Article 820.
f. Roppe Corporation; 700 Series TPR Wall Base - Style B (Coved).
g. Substitutions: See Section 016000 - Product Requirements.

2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
3. Height: 4 inch.
4. Thickness: 0.125 inch minimum.
5. Finish: Satin.
6. Length: Roll; manufacturer's standard length.
7. Color: To be selected by Architect from manufacturer's full range.

2.02 STAIR COVERING

A. Stair Tread with Intergral Riser and Contrasting Nosing: Rubber; full width and depth of stair tread in one piece; tapered thickness.
   1. Manufacturers:
      a. C.I. Takiron. Stair Treads
      b. Substitutions: See Section 016000 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F2169, Type TV, Class 2.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. Nominal Thickness: 0.250 inch, tapered towards rear.
   5. Nosing: Square, adjustable; 1-1/2 inch height.
   6. Texture: Slip-Resistant surface, with pattern selected from manufacturer's full range.
   7. Color: To be selected by Architect from manufacturer's full range.

B. Stair Stringers: Full height in one piece and in maximum available lengths, matching treads in material and color.
   1. Manufacturer: Provide stringers by same manufacturer as treads.
   2. Nominal Thickness: 0.080 inch.

2.03 MOLDINGS, TRANSITIONS, AND EDGE STRIPS

A. Moldings, Transition and Edge Strips:
   1. Manufacturers:
      a. Flexco, Inc.
      b. Johnsonite.
      c. Mannington Commercial.
      d. R.C.A. Rubber Company (The).
      e. Roppe Corporation.
      f. VPI, LLC; Floor Products Division.
      g. Substitutions: See Section 016000 - Product Requirements.
   2. Molding/Transition Strip Profiles: Provide in sizes as required to suit flooring thicknesses and applications.
      a. Coved edge/cap for carpet.
      b. Joiner between carpet and resilient flooring or other materials with different heights.
      c. Transition strip between different types of materials that are the same height or between different styles/patterns of the same material.
      d. Slim transition strip with approximately 1/4-inch wide visible transition profile.

e. Reducer strip at edges of flooring to reduce height to 0".
f. Subfloor leveling accessory to transition between materials with height differences up to 1/2 inch.

3. Material: Manufacturer's standard rubber or vinyl.
4. Color: To be selected by Architect from manufacturer's full range.

2.04 ACCESSORIES

A. Leveling Compound: Blended cement mix, latex-modified, for use as trowelable underlayment, approved by resilient accessory manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moisture Vapor Treatment: Where resilient flooring and accessories are installed over concrete slabs, provide alkaline-resistant product designed to control excessive moisture vapor transmission through concrete slab, per the following:

1. Products: Provide product approved by flooring manufacturer and complying with performance requirements below, equivalent to one of the following:
   a. Duraamen Engineered Products, Inc.; Perdure MVT.
   b. Maxxon Corporation; Maxxon MVP.
   c. Tnemec Company Inc.; Epoxoprime MVT, Series 208.
2. Performance Requirements:
   a. Verify with flooring manufacturer that submitted product maintains compliance with all provisions of flooring manufacturer’s warranty.
   b. Low-VOC: Provide product with VOC content less than 15 g/L.
   c. Bond Strength to Concrete: Minimum 400 psi per ASTM D 4541 (100% concrete failure).
   d. Permeance: Maximum 0.1 perm per ASTM E 96, and 0.10 grains/hr/ft^2/in-Hg, per ASTM F3010.
   e. Applications: Provide MVT for all concrete slabs on-grade and lightweight concrete elevated slabs.

D. Floor Polish: Fluid-applied polish recommended by resilient flooring manufacturer.

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.

1. Do not apply wall base until other finish items, including casework and painting, are complete.

C. Cementitious Subfloor Surfaces (Stair Treads/Landings): Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:
   a. Alkalinity (pH): ASTM F710, when required by stair accessory manufacturer.
   b. Internal Relative Humidity: ASTM F2170. One test per stair area.
   c. Moisture Vapor Emission: ASTM F1869. One test per stair area.

2. If test results are not within limits recommended by stair accessory manufacturer, apply moisture vapor treatment (MVT) in accordance with manufacturer's requirements. MVT shall be provided per unit price and quantity allowance requirements.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with leveling compound to achieve smooth, flat, hard surface.

C. Prohibit traffic until leveling compound is fully cured.

D. Clean substrate.

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. Fit joints and butt seams tightly.
   2. 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, install such that molding profiles or transition strips are centered under the door panel.

E. Install edge/reducer strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

C. Job form internal and external corners in accordance with manufacturer's instructions. Form corners by "V" cutting or scribing; do not bend material in a manner that creates stress whitening.

D. In addition to walls, install base on other permanent construction with exposed vertical faces at floor level, including, but not limited to, columns, pilasters, and casework/cabinet knee and toe spaces.

E. Scribe and fit to door frames and other interruptions.

F. At uneven substrate surfaces (such as masonry mortar joints), provide manufacturer's recommended filler sealant or adhesive to fill voids along top of base.

3.05 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Install stringers configured tightly to stair profile.

C. Adhere over entire surface. Fit accurately and securely.

D. Clean stair tread and landing accessories and apply floor polish according to manufacturer's written instructions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient accessories for 48 hours after installation.

B. Cover resilient accessories and protect from heavy construction traffic and equipment until Substantial Completion.

END OF SECTION 096513

SECTION 096519
RESILIENT TILE FLOORING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.02 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

B. Shop Drawings: Indicate seaming plans, floor patterns, and dye lot.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Flooring Material: Quantity equivalent to 5 percent of each type and color.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

1.04 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 to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide a ten (10) year manufacturer warranty, covering defective material and installation.

C. Installer's Warranty: Installer shall warrant that the products have been installed in accordance with manufacturer's instructions.

1. The installer shall provide a ten (10) year warranty against product failure due to excessive moisture vapor transmission through the slab.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Tile - LVT: Printed film type, with transparent or translucent wear layer; acoustic interlayer or backing.
   1. Manufacturers:
      a. Armstrong Flooring; Natural Creations with Diamond 10 Technology.
      b. Shaw Contract; Terrain II
      c. Six Degrees; Compass. (Basis of Design)
      d. TBD
   2. Minimum Requirements: Comply with ASTM F1700, Class III (Printed Film Vinyl Tile).
      a. Type: Type B; Embossed Surface.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648.
   4. Plank Tile Size: 6 by 48 inch.
   5. Wear Layer Thickness: 28 mil, minimum.
   6. Color and Pattern: To be selected by Architect from manufacturer's full range.

2.02 ACCESSORIES

A. Subfloor Filler: Type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moisture Vapor Treatment: Where resilient flooring and accessories are installed over concrete slabs, and where field testing indicates high moisture vapor testing through concrete slabs, provide alkaline-resistant product designed to control excessive moisture vapor transmission through concrete slab in accordance with Division 01 MVT allowance and unit price, and per the following:
   1. Products: Provide product approved by flooring manufacturer and complying with performance requirements below, equivalent to one of the following:
      a. Duraamen Engineered Products, Inc.; Perdure MVT.
      b. Maxxon Corporation; Maxxon MVP.
      c. Tnemec Company Inc.; Epoxoprime MVT, Series 208.
   2. Performance Requirements:
      a. Verify with flooring manufacturer that submitted product maintains compliance with all provisions of flooring manufacturer’s warranty.
      b. Low-VOC: Provide product with VOC content less than 15 g/L.
      c. Bond Strength to Concrete: Minimum 400 psi per ASTM D 4541 (100% concrete failure).
      d. Permeance: Maximum 0.1 perm per ASTM E 96, and 0.10 grains/hr/ft^2/in-Hg, per ASTM F3010.
      e. Applications: Provide MVT for all concrete slabs on-grade and lightweight concrete elevated slabs.

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. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows: Perform one of each test per 1,000 sf of installation area.
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. If test results are not within limits recommended by flooring manufacturer, apply moisture vapor treatment (MVT) in accordance with manufacturer's requirements. MVT shall be provided per unit price and quantity allowance requirements.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

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. Fit joints and butt seams tightly.
   2. 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. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern, unless otherwise indicated.

C. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.05 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 096519

SECTION 096623
RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

B. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

C. NTMA (GRAD) - Aggregate Gradation Standards.

D. NTMA (EPOXY) - Epoxy Terrazzo Specifications.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting at the Project site one week before starting work of this section. Require attendance by concrete subcontractor and any other relevant installers.

1. Review the work of this section, including substrate requirements, including slab recesses, control joints, and preparation.
2. Review scheduling, material deliveries, and temporary facilities and equipment that will be required, and installation procedures.
3. Review specialty finishes, patterns and designs. Review special conditions such as stair treads and nosings.
4. Review protection of the finished work, including traffic limitations and protection measures.

1.03 SUBMITTALS

A. 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.

1. Include product data for manufacturer's moisture vapor treatment product.

B. Shop Drawings: Indicate complete terrazzo layout, including patterns and colors. Indicate divider strip and control and expansion joint layout, and details of adjacent components.

1. Include stair tread, riser, and landing details.

C. Samples: Submit three samples of each color, 6 inch by 6 inch in size illustrating color, chip size and variation, chip gradation, matrix color, and typical divider strip.

D. Verification Samples: Include terrazzo samples approximately 6 inches square illustrating project-specific colors, chip size and variation, chip gradation, and matrix color. Include samples of divider strips

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing. Include specific cleaners and chemicals that should not be used on terrazzo.

H. Manufacturer's Inspection Reports.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with NTMA's "Terrazzo Specifications and Design Guide" and with recommendations as posted at their web site at www.ntma.com.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
   1. Minimum five years of documented experience.
   2. Associate member firm of the National Terrazzo and Mosaic Association, Inc.

C. Installer Qualifications: Company specializing in performing the type of work specified in this section.
   1. Minimum five years of documented experience.
   2. Approved by matrix manufacturer.
   3. Contractor member of the National Terrazzo and Mosaic Association, Inc.

D. Coordination: Epoxy terrazzo flooring manufacturer shall review and approve cast-in-place concrete contractor's quality control measures and shop drawings to ensure concrete slab placement, slab recesses, and finish are acceptable for application of terrazzo.

1.05 MOCK-UP

A. Construct mock-up of terrazzo illustrating appearance of finished work in each configuration required. Size mock-up to be not less than 100 square feet.
   1. Include control joint(s) with divider strip, and include multiple adjacent colors to verify color selections, as applicable.
   2. Include a section with terrazzo wall base.

B. Locate where directed.

C. Approved mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store terrazzo materials in a dry, secure area.

B. Maintain minimum temperature of 60 degrees F.

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 or above 90 degrees F.

B. Prior to and during each day of installation, the terrazzo contractor shall verify that the dew point is at least 5 degrees F less than the slab and air temperature.

C. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.

D. Provide ambient lighting with permanent lighting or with lighting that simulates facility's permanent lighting.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Resinous Matrix Terrazzo Flooring:
   1. Master Terrazzo Technologies LLC; Morricite.
   2. Sherwin-Williams High Performance Flooring; Terrazzo 1100.
   3. TEC Specialty Construction Brands, Inc; Tuff-Lite Epoxy Terrazzo.
   4. Terrazzo & Marble Supply Companies; Terroxy Resin Systems.
   5. Substitutions: See Section 016000 - Product Requirements.

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS

A. Floors:
   1. Thickness: 3/8 inch, nominal.
   2. Color(s): To be selected by Architect. There will be one color.
   3. Aggregate Type: Marble chips.
   4. Aggregate Size: No. 2.

B. Wall Base:
   1. Thickness: 3/8 inch, minimum.
   2. Style: Straight, Recessed (flush with finish face of wall)
   3. Color(s): To be selected by designer from manufacturer's full color range.
   4. Aggregate Type and Size: Same as floors.

C. Precast Wall Panel:
   1. Thickness: 3/8 inch, minimum.
   2. Size(s): As indicated on drawings.
   3. Style: Panel
   4. Color(s): To be selected by designer from manufacturer's full color range.
   5. Aggregate Type and Size: Same as floors.

D. Stairs - Treads, Risers, Stringers, and Landings: Precast epoxy terrazzo.
   1. Thickness: Same as floors.
   2. Thickness: 1-1/2 inch, minimum.
   3. Color(s): To be selected by designer from manufacturer's full color range.
   4. Aggregate Type and Size: Same as floors.

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.

E. Precast Epoxy Terrazzo Units: Fabricate to sizes and profiles indicated on drawings.

2.04 ACCESSORIES

A. Divider Strips: 1/8 inch thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.

B. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.

C. Anchors and Reinforcement for Precast Units: As recommended by manufacturer for type of installation.

D. Sealer: Colorless, non-yellowing, non-strippable, penetrating liquid urethane type to completely seal matrix surface; not detrimental to terrazzo components.
   1. Products:

a. Essential Industries, Inc; T-Rx.
b. Master Terrazzo Technologies; Morricite WB Urethane Sealer 158.
c. Terrazzo & Marble Supply Companies; Terroxy WB Urethane Sealer.

E. Primer: Manufacturer's recommended product; compatible with indicated substrate.

F. Moisture Vapor Treatment: Provide terrazzo manufacturer's recommended alkaline-resistant product designed to control excessive moisture vapor transmission through concrete slab, per the following:
1. Performance Requirements:
a. Verify with flooring manufacturer that submitted product maintains compliance with all provisions of flooring manufacturer's warranty.
b. Low-VOC: Provide product with VOC content less than 15 g/L.
c. Bond Strength to Concrete: Minimum 400 psi per ASTM D 4541 (100% concrete failure).
d. Permeance: Maximum 0.3 perm per ASTM E 96.
e. Applications: Provide MVT for all concrete slabs on-grade and lightweight concrete elevated slabs.

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. Cementitious Subfloor Surfaces: Provide manufacturer's recommended moisture vapor treatment at all locations to receive terrazzo floor finish; moisture vapor treatment at terrazzo is not subject to MVT unit price or allowance specified in other sections. Verify that substrates are ready for terrazzo flooring installation by testing for moisture and alkalinity (pH).
1. Test as Follows: Provide one of each test in each installation area, unless otherwise required by manufacturer:
a. Alkalinity (pH): ASTM F710.
b. Internal Relative Humidity: ASTM F2170.

C. Verify that any required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Clean substrate of foreign matter.

B. Prepare concrete subfloor by shot-blasting surface in accordance with manufacturer's instructions, and according to ICRI Technical Guidelines for CSP 3 or 4 surface profile.
1. Acid washing and/or grinding of concrete slabs is not allowed.
2. Review vacuum blasted concrete slab substrate for cracks with the terrazzo manufacturer's technical representative. Rout out and fill significant non-moving cracks with epoxy resin, and patch lesser non-moving cracks with fine mesh strip set into wet primer and embedded in epoxy resin as recommended by technical representative.
3. Provide an epoxy or cementitious pre-fill material manufactured or recommended by epoxy flooring manufacturer and compatible with flooring system to fill low slab areas to attain acceptable substrate. This companion material is considered part of the epoxy terrazzo flooring system and shall be included in the system warranty. Gypsum composition underlayment pre-fill material is not acceptable.

C. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install divider strips according to pattern approved on shop drawings.

B. Place terrazzo mix over substrate to thickness indicated.

C. Anchor precast units as indicated on drawings.

D. Install precast units using specified setting material.

3.04 FINISHING

A. Finish terrazzo to NTMA requirements.

B. 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.

C. Apply grout to fill voids exposed from grinding.

D. Remove grout coat by grinding, using a fine grit abrasive.

3.05 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch in 10 feet.

B. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch.

3.06 FIELD QUALITY CONTROL

A. Provide on-site inspection by terrazzo manufacturer's representative at minimum two times during installation of this work. Installing Contractor shall notify manufacturer of installation start date and scheduling. Manufacturer's representative shall provide written copies of inspection reports within 10 days of inspection date.

1. The first inspection shall be of the mockup, or, if no mockup is specified, of the first 100 square feet of the install.
2. The second inspection shall be at substantial completion.
3. The installing contractor shall be responsible for immediate repairs or corrections to the work.

3.07 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 NTMA and manufacturer's instructions.

C. Polish surfaces in accordance with manufacturer's instructions.

3.08 PROTECTION

A. Do not allow traffic on installed terrazzo for the period required by manufacturer's instructions, or 24 hours, whichever is longer.

B. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

C. Leave the finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective terrazzo work. Repair or replace defective terrazzo work to attain the specified NTMA standards for finished work. The party responsible for the damaged or otherwise non-conforming work shall be responsible for the cost of repairs.

END OF SECTION 096623

SECTION 096813
TILE CARPETING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

E. CRI 104 - Standard for Installation of Commercial Carpet.

F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Substitutions/Prequalification: Manufacturers seeking consideration to bid their product as an acceptable alternative shall provide full product data and full range of selection samples during the bid period. Products that do not meet the technical and aesthetic criteria will not be accepted. No substitutions shall be permitted for carpet tile after receipt of bids.

1.03 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

B. Shop Drawings: Indicate layout of joints, direction of carpet pile, dye lot, and location of edge moldings and transition strips.

1. Where multiple carpet tile products are specified (including multiple products in a single space installed in an indicated pattern), indicate on the shop drawings the locations where each product is being installed.

C. Selection Samples: Submit manufacturer's color charts indicating full range of colors for carpet tiles and for accessories.

D. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1. Include specific procedures and materials that are not recommended, including those that may be harmful to carpet tile or that would void warranty.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

A. Critical Radiant Flux: All carpet tiles shall be Class I rated, with a minimum CRF of 0.45 watts/sq cm, when tested by an independent testing agency in accordance with ASTM E648 or NFPA 253.

1.05 FIELD CONDITIONS, STORAGE AND HANDLING

A. Comply with the Carpet and Rug Institute (CRI) Publication "CRI 104 - Standard for Installation of Commercial Carpet." Comply with Section 4.0 for storage and handling, Section 7.0 for ambient temperature and ventilation, and Section 9.0 for Product Acclimation.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Carpet Tile Warranty: Provide a ten (10) year manufacturer warranty, covering defective material and faulty installation.

1. Warranty shall cover excessive surface wear (defined as more than 10% loss by weight of face fiber), edge raveling, backing separation, shrinking, stretching, cupping, doming, static electricity, or color loss or fading.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting: Provide the basis-of-design carpet tiles or a prequalified alternate tile. No substitutions will be considered after the award of Contract.

1. Bentley Mills.
2. Mannington Commercial.
3. Milliken & Company.

2.02 MATERIALS

A. Tile Carpeting, Type C-TILE-A: Tufted, manufactured in one color dye lot.

1. Product: Natural Elements Too manufactured by Mannington Commercial.
2. Tile Size: 12 by 36 inch, nominal.
3. Color: As selected from Manufacturer's full range. .
4. Pattern: As selected from collections full range..
5. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
6. Gauge: 1/12 inch.
7. Primary Backing Material: Manufacturer's standard; recycled vinyl with fiberglass reinforcing.
8. Total Weight: 15 oz/sq yd.
9. Installation Method: Vertical Ashlar or as recommended by Manufacturer.

B. Tile Carpeting, Type C-TILE-B: Tufted, manufactured in one color dye lot.

1. Product: Natural Elements Too manufactured by Mannington Commercial.
2. Tile Size: 12 by 36 inch, nominal.
3. Color: As selected from Manufacturer's full range. .
4. Pattern: As selected from collections full range..
5. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
6. Gauge: 1/12 inch.
7. Primary Backing Material: Manufacturer's standard; recycled vinyl with fiberglass reinforcing.
8. Installation Method: Vertical Ashlar or as recommended by Manufacturer.

C. Tile Carpeting, Type C-TILE-C: Entrance Carpet Tile, Tufted, manufactured in one color dye lot.
   1. Product: Obex manufactured by Milliken and Company.
   2. Tile Size: 50 by 50 cm, nominal
   3. Color: As selected from Manufacturer's full range. .
   4. Pattern: As selected from collections full range..
   5. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   6. Primary Backing Material: Manufacturer's standard; recycled vinyl with fiberglass reinforcing.

2.03 ACCESSORIES

A. Subfloor Filler: Type recommended by flooring material manufacturer.

B. Edge Strips: Rubber, color as selected by Architect.

C. Moisture Vapor Treatment: Where carpeting and accessories are installed over concrete slabs, provide alkaline-resistant product designed to control excessive moisture vapor transmission through concrete slab, per the following:
   1. Products: Provide product approved by flooring manufacturer and complying with performance requirements below, equivalent to one of the following:
      a. Duraamen Engineered Products, Inc.; Perdure MVT.
      b. Maxxon Corporation; Maxxon MVP.
      c. Tnemec Company Inc.; Epoxoprime MVT, Series 208.
   2. Performance Requirements:
      a. Verify with flooring manufacturer that submitted product maintains compliance with all provisions of flooring manufacturer’s warranty.
      b. Low-VOC: Provide product with VOC content less than 15 g/L.
      c. Bond Strength to Concrete: Minimum 400 psi per ASTM D 4541 (100% concrete failure).
      d. Permeance: Maximum 0.1 perm per ASTM E 96, and 0.10 grains/hr/ft^2/in-Hg, per ASTM F3010.
      e. Applications: Provide MVT for all concrete slabs on-grade and lightweight concrete elevated slabs.

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. Test as Follows: Perform one of each test per 1,000 sf of installation area.
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.

2. If test results are not within limits recommended by flooring manufacturer, apply moisture vapor treatment (MVT) in accordance with manufacturer's requirements. MVT shall be provided per unit price and quantity allowance requirements.

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.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).

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. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines, unless otherwise indicated.

F. Locate change of color or pattern between rooms or at transitions to other finish flooring material directly under the door leaf centerlines, or at the center of cased openings.

G. Fully adhere carpet tile to substrate.

H. Install carpet tile into wall recesses, knee spaces under cabinets or countertops, closets, and other similar spaces.

I. Trim carpet tile neatly at walls and around interruptions.

J. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING AND PROTECTION

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

C. Protect installed carpet in accordance with CRI 104, Section 13.7 "Post Installation."

END OF SECTION 096813

SECTION 097200
WALL COVERINGS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics.

D. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2.

E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.

F. SCAQMD 1168 - Adhesive and Sealant Applications.

1.02 SUBMITTALS

A. Product Data: Provide data on wall covering and adhesive.

B. Shop Drawings: Indicate wall elevations with seaming layout.

C. Selection Samples: Provide manufacturer's full range of color and pattern information.

D. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Wall Covering Materials: 25 linear feet of each color and pattern of wall covering; store where directed.

1.03 QUALITY ASSURANCE

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

1.04 MOCK-UPS

A. Provide panel, approximately 10 feet wide, full height, illustrating installed wall covering and joint seaming technique. Include inside and outside corner, as applicable.

B. Locate where directed by Architect.

C. Mock-up may remain as part of the Work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surfaces.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. General Requirements:
   1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
   2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.
   3. Low-Emitting Materials:
      a. Paints and Coatings: Paints and coatings field-applied inside the weatherproofing system shall be tested and determined compliant in accordance with CAL (CDPH SM) AND shall meet applicable VOC limits of CARB (SCM) or SCAQMD 1113.
      b. Adhesives and Sealants: Adhesives and sealants field-applied inside the weatherproofing system shall be tested and determined compliant in accordance with CAL (CDPH SM) AND shall meet the chemical content requirements of SCAQMD 1168.

B. Wall Covering - Type VWC: Woven-backed vinyl roll stock with a protective coating.
   1. Comply with ASTM F793/F793M, Category VI, Type III.
   2. Roll Width: 52 inches.
   3. Backing: Woven fabric.
   4. Color: As selected from Manufacturer's full range..
   5. Pattern: Urbane by Koroseal (Basis of Design)
   6. Pattern Match: Random Match, Reverse Hang
   7. Repeat: N/A
   8. Abrasion Resistance; ASTM D-4977, Level 3
   9. Impact Resistance; ASTM D-5420, Level 2
   10. Manufacturers:
      a. Koroseal/RJF International.
      b. MDC Wallcoverings.
      c. Wolf-Gordon; Sparta.
      d. MDC
      e. Substitutions: See Section 016000 - Product Requirements.

C. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

D. Termination Trim: Extruded plastic, clear.

E. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

F. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

B. Measure moisture content of surfaces using an 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 nor vary at a rate greater than 1/16 inch/ft.

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces that affect work of this section.

E. Marks: Seal with shellac those that may bleed through surface finishes.

F. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

G. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Use wall covering in roll number sequence.

D. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

F. Butt edges tightly.

G. Do not seam within 2 inches of internal corners or within 6 inches of external corners.

H. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

I. Do not install wall covering more than 1/4 inch below top of resilient base.

J. Apply wall covering to electrical wall plates prior to replacing.

K. Install termination trim.

L. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION 097200

SECTION 098414
ACOUSTIC STRETCHED-FABRIC WALL AND CEILING SYSTEMS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.

B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

E. ASTM E2573 - Standard Practice for Specimen Preparation and Mounting of Site-Fabricated Stretch Systems to Assess Surface Burning Characteristics.

1.02 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Specimen warranty.

B. Shop Drawings: Details indicating typical transitions to other finish surfaces and elevations indicating proposed locations of fabric seams.
   1. Include mounting and attachment details, and details at edges, corners and other special conditions.

C. Selection Samples: Fabric swatches representing manufacturer's full range of available colors, textures, and patterns.

D. Test Reports: Certified test data from an independent test agency verifying that wall systems meet specified requirements for acoustical and fire performance.

E. Installer's Qualification Statement.

F. Warranty Documentation: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of the type specified; trained or certified by manufacturer for installation of specified products.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect fabric, acoustical backing, and track from excessive moisture in shipment, storage, and handling.

B. Do not deliver materials to project until wet work such as concrete and plaster has been completed.

C. Store products in manufacturer's unopened packaging until ready for installation.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.05 FIELD CONDITIONS

A. Do not begin installation until interior conditions have reached temperature and humidity that will be maintained during occupancy.

B. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Stretched-Fabric Wall Systems:
   1. Accutrack Systems.
   2. Conwed.
   3. Fabric Wall.
   4. Fabricmate Systems.
   5. FabriTRAK Systems, Inc.
   6. Novawall Systems, Inc.
   7. Substitutions: See Section 016000 - Product Requirements.

2.02 ACOUSTIC STRETCHED-FABRIC SYSTEM

A. Acoustic Stretched-Fabric System: Field installed, fabric is stretched and set into framework and laid over acoustic material anchored to substrate. Framework consists of continuous perimeter and intermediate mounting frames anchored to substrate, and designed to permit removal and replacement of fabric within framed areas without affecting adjacent areas.
   1. Surface Burning Characteristics: Flame Spread Index of 25, maximum; Smoke Developed Index of 450, maximum; when whole system is tested in accordance with ASTM E84 using mounting specified in ASTM E2573 for stretched systems.
      a. Surface Burning Characteristics tested by ASTM E 2573 shall be for the complete assembly, including framing extrusions, core material, and fabric covering.
   2. Noise Reduction Coefficient (NRC): 0.80, minimum, when tested in accordance with ASTM C423, Type A mounting per ASTM E795.
   3. Prefabricated, fabric covered and individually framed panels are not permitted.
   4. Install fabric over acoustic material and into framework without use of adhesives, tapes, or fasteners.
   5. Seams in fabric are not permitted; adjust frame layouts to accommodate width of fabric; obtain written approval of frame layouts from Architect.

2.03 MATERIALS

A. Frame: Extruded polymer framing system with serrated jaws of sufficient strength to hold fabric in place after repeated applications.
   1. Wall Frame Size: 1 inch height from wall substrate to match core thickness; with minimum 1 inch wide base.
      a. Wall Frame Shape: Bevel at perimeter, and square at intermediate abutting joints.

b. Reveal: 1/2-inch.

B. Acoustic Material:
1. Provide type of acoustic material in thickness required to achieve Noise Reduction Coefficient (NRC) indicated.
2. Ensure that thickness of acoustic material fills depth of frame as necessary for application without use of support blocking.
3. Compressed Fiberglass Board: Class A fire rated in accordance with ASTM E84.
a. Overall Thickness: 1 inch.

C. Rigid Blocking: Fire-retardant treated medium density fiberboard complying with ANSI A208.2, in thickness to meet project requirements.

D. Fabric: Basis of Design is Maharam, Product Style "Tek Wall Volta."
1. Other Acceptable Manufacturers:
a. ArcCom.
b. Designtex.
c. Substitutions: See Section 016000 - Product Requirements.
2. Wall Color: Selected from full range available from basis-of-design style.
3. Width: 54 inch minimum.

E. Fasteners: As recommended by manufacturer of acoustic stretched-fabric system in accordance with project requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Begin installation only after substrates have been properly prepared.

B. Verify that casework, markerboards, door and window jambs, finished ceiling, and other finished items adjacent or abutting the acoustic stretched-fabric system have been properly installed.

C. When preparation of substrate is the responsibility of another installer, notify Architect of unsatisfactory preparation prior to proceeding with this work.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation of this work.

B. Prepare substrate surfaces using methods as recommended by the manufacturer for achieving acceptable result as required for this work.

C. Remove wall plates and other obstacles, and properly prepare substrates to receive frames and acoustic material in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install acoustic stretched-fabric system at locations indicated in accordance with approved shop drawings and manufacturer's instructions.

B. Frames: Install perimeter and intermediate frames using appropriate fasteners for prepared substrate, firmly secured to ensure frames do not separate from substrate.
1. For tile or masonry substrates, apply continuous bead of adhesive along base of framing in addition to spacing of conical anchors and/or fasteners at 6 to 8 inches on center.
2. Follow contours of wall and scribe to adjoining work at borders, penetrations, and imperfections.

3. Install framing around openings and penetrations.
4. Allow for spacing of framework to accommodate insertion of installation tool.

C. Acoustic Material: Cut and trim acoustic material to fit snugly within perimeter and intermediate framework.
1. Apply adhesive and press acoustic material into place, maintaining constant plane.
2. At fixtures mounted within areas of acoustic stretched-fabric system, install rigid blocking for backing and maintain plane of fixture surface flush with face of acoustic stretched-fabric system.

D. Fabric: Stretch fabric over acoustic material, locking edges of fabric into frame's serrated jaws using manufacturer's recommended tool. Maintain fabric weave plumb, level and true, in proper relation to building lines, without ripples, waviness, hourglass, or other deleterious effects.
1. Upon fabric installation, do not employ adhesives or mechanical fasteners of any type, and ensure fabric is free-floating and in contact with acoustic material as necessary.
2. Stapling or gluing of fabric to cores or channel framework is not permitted.
3. Provide tension in fabric sufficient to prevent sagging under anticipated changes in temperature and humidity.
4. At outside corners, wrap as single piece of fabric without joints, seams, or visible framing; unless otherwise indicated.

3.04 CLEANING

A. Clean exposed surfaces of acoustic stretched-fabric system in compliance with manufacturers instructions for cleaning and repair of minor damage to exposed surfaces.

B. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage to system.

3.05 PROTECTION

A. Protect installed materials upon completion of this work, using methods that will ensure that the finished work is without damage or deterioration upon Date of Substantial Completion.

END OF SECTION 098414

SECTION 099100
PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior and interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated. Specific items include (but are not limited to) the following:

1. Fire- and Smoke-Rated Wall Identification: Permanently label fire- and smoke-rated walls, partitions, and barriers per requirements of applicable building code. Labeling shall include fire-resistance rating, type of assembly, and instruction to protect openings/penetrations. Example text: "ONE HOUR FIRE BARRIER - PROTECT ALL OPENINGS".
    a. Locate lettering in concealed accessible floor, floor-ceiling plenums, and attic spaces, located no more than 15 feet from end of wall and at horizontal intervals not exceeding 30 feet, with stenciled lettering not less than 3 inches high with minimum 3/8-inch strokes. Locate directly inside of access doors or panels that provide access to rated walls. Do not paint walls where exposed to view except in support spaces (mechanical / electrical rooms and similar spaces).
2. Refer to the life safety plans and partition schedule on the drawings for rated wall and partition locations.
3. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
4. Elevator pit ladders.
5. Prime surfaces to receive wall coverings.
6. 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. 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.
    c. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
7. Shop-Primed Items: In finished areas, paint shop-primed items. Unless specifically indicated that additional field primer is not required, provide a tie coat primer over the shop primer before top coat(s) are applied.

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. Brick, architectural concrete, architectural precast, cast stone, and integrally colored plaster, fiberglass, or stucco.
10. Glass.
11. Acoustical materials, unless specifically indicated.
12. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

A. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2.

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

C. SSPC-SP 1 - Solvent Cleaning.

D. SSPC-SP 6 - Commercial Blast Cleaning.

1.03 SUBMITTALS

A. 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. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

1.04 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 and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.05 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 above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Paints:
   1. Benjamin Moore.

2. PPG Paints.
3. Sherwin-Williams Company.

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. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Low-Emitting Materials (Paints and Coatings): Paints and coatings field-applied inside the weatherproofing system shall be tested and determined compliant in accordance with CAL (CDPH SM) AND shall meet applicable VOC limits of CARB (SCM) or SCAQMD 1113.

2.03 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. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. 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.

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 repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

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.

G. 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.

H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

J. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

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. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

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 in thicknesses specified by manufacturer.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. 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.

3.06 EXTERIOR PAINT SCHEDULE

A. General: Provide the following Paint systems for the various substrates, as indicated. Dry film thickness is noted as “DFT.” Provide compatibility test areas on existing painted substrates.

B. Zinc-Coated or Zinc-rich Primer-Coated Metal with Direct to Metal (“DTM”) Gloss Acrylic Enamel Finish: 2 topcoats of DTM gloss enamel over primer, with min. total DFT of 2.5 mils.
   1. Prime Coat (Tie-Coat): Lead-free, acrylic base interior/exterior galvanized metal primer, premium grade. Apply over shop primer.
      a. Moore: HP04 Ultra Spec HP Acrylic Metal Primer.
      b. PPG: 90-712 Pitt-Tech Int/Ext Primer/Finish Industrial Enamel.
      c. S-W: B66W1310 Pro Industrial Pro-Cryl Universal Acrylic Primer.
   2. First and Second Coats: DTM Acrylic Gloss Enamel.

a. Moore: HP28 Ultra Spec HP Acrylic Gloss Enamel.
b. PPG: 90-1310 Pitt-Tech Plus Int/Ext High Gloss DTM Industrial Enamel.
c. S-W: B66W1051 Pro Industrial DTM Acrylic Coating (Gloss).

C. Field-Applied Coatings for Ferrous Metal (AESS): Aliphatic urethane system of intermediate coat and topcoat. Provide scheduled products for exposed steel fabrications indicated as AESS.
1. Field Touch-up: Match moisture curing urethane zinc-rich shop primer.
2. Intermediate Coat: Moisture curing urethane and micaceous iron oxide or epoxy.
a. Moore: Corotech V160 Epoxy Mastic Coating.
b. PPG: 95-245 Pitt-Guard Rapid Coat D-T-R Epoxy Coating.
c. S-W: Macropoxy 646 Fast Cure Epoxy, B58-600/B58v600.
3. Top Coat: Aliphatic urethane at 2.0 – 3.0 mils DFT.
a. Moore: Corotech V500 Aliphatic Acrylic Urethane.
b. PPG: 95-812 Pitthane Ultra Gloss Urethane Enamel.
c. S-W: Corothane I Aliphatic Finish Coat B65.

D. Coatings to Repaint Exterior Ferrous Metal: Aliphatic urethane topcoat system over surface-tolerant epoxy mastic. Provide to repaint existing exposed steel fabrications with extended weather exposure deterioration and surface rust.
1. Preparation: Clean steel to SSPC SP-3 Power Tool Cleaning to remove all rust scale, mill scale and loose rust, oil, grease and other contaminants.
2. Primer: Surface-tolerant fast curing polyamide epoxy (mastic). 5.0 – 10.0 mils DFT.
a. Moore: P45 Mastic Epoxy Gloss Coating.
b. PPG: 95-245 Pitt-Guard Rapid Epoxy Mastic SG.
c. S-W: Macropoxy 646 Fast Cure Epoxy.
3. First and Second Top Coats: Aliphatic urethane at 3.0 – 4.0 mils DFT per coat
a. Moore: P74 Aliphatic Acrylic Urethane.
b. PPG: Pitthane High Build Urethane Enamels 95 -8800 series.
c. S-W: B65-300 Series / B60V30 Hi-Solids Polyurethane.

E. Concrete: Acrylic latex satin finish, two finish coats over alkali-resistant primer with minimum total DFT of not less than 3.5 mils.
1. Prime Coat: Exterior Acrylic weathered masonry sealer/primer.
a. Moore: 608 Ultra Spec Masonry Int/Ext 100% Acrylic Sealer/Primer.
b. PPG: 4-603 Perma-Crete Int/Ext Alkali Resistant Primer.
c. S-W: A24w8300, Loxon Concrete & Masonry Primer.
2. First and Second Finish Coats: Exterior 100% Acrylic – Satin sheen; premium grade.
a. Moore: N401 Regal Select Exterior Paint High Build Low Lustre Finish.
b. PPG: 76-45 Sun-Proof Ext House & Trim, Satin.
c. S-W: A82 Series A-100 Exterior Latex Satin.

F. Concrete Masonry Units: Acrylic latex satin finish, two finish coats over primer with minimum total DFT of not less than 3.5 mils.
1. Prime Coat: Exterior Acrylic weathered masonry sealer/primer.
a. Moore: 571 Ultra Spec Hi-Build Masonry Block Filler.
b. PPG: 6-15 Speedhide Int/Ext Acrylic Masonry Block Filler.
c. S-W: A24W200 Loxon Block Surfacer.
2. First and Second Finish Coats: Exterior 100% Acrylic – Satin sheen; premium grade.

a. Moore: N401 Regal Select Exterior Paint High Build Low Lustre Finish.
b. PPG: 76-45 Sun-Proof Ext House & Trim, Satin.
c. S-W: A 82 Series A-100 Exterior Latex Satin.

G. Exterior Gypsum Soffit Board with Smooth Finish 100% Acrylic Coating: Top coat(s) for total DFT of 10.0 mils minimum over primer-sealer.
1. Prime Coat (Tie-Coat): Bonding primer-sealer.
a. Moore: N023 Fresh Start All Purpose 100% Acrylic Int/Ex Latex Primer.
b. PPG: 6-9 Speedhide Exterior Wood Primer Oil.
c. S-W: B51-450, Multi-Purpose Primer.
2. First and Second Finish Coats: Exterior 100% Acrylic – Satin sheen; premium grade.
a. Moore: N401 Regal Select Exterior Paint High Build Low Lustre Finish.
b. PPG: 76-45 Sun-Proof Ext House & Trim. Satin Latex 100% Acrylic.
c. S-W: A82 Series A-100 Exterior Latex Satin.
3. First and Second Finish Coats: Exterior 100% Acrylic – Flat finish; premium grade.
a. Moore: N400 Regal Select Exterior Paint High Build Flat Finish.
b. PPG: 72-45 Sun-Proof Ext House & Trim. Flat Latex 100% Acrylic
c. S-W: A6 Series A-100 Exterior Latex Flat

H. General Painted Wood and Plywood with Acrylic Latex Satin Finish: 2 finish coats over primer with total DFT not less than 3.5 mils.
1. Prime Coat: Alkyd-based wood sealer/primer.
a. Ben Moore: 024 Fresh Start Multi-Purpose Oil Based Primer.
b. PPG: 6-9 Speedhide Exterior Wood Primer
c. S-W: Y24W8020 Exterior Oil Wood Primer.
2. First and Second Finish Coats: Exterior 100% Acrylic – Satin sheen; premium grade.
a. Moore: N401 Regal Select Exterior Paint High Build Low Lustre Finish.
b. PPG: 76-45 Sun-Proof Ext House & Trim, Satin.
c. S-W: A82 Series A-100 Exterior Latex Satin.

I. Exterior Wood Dumpster Enclosure Siding and Trim with Solid Color Latex-Emulsion Stain: 2 Finish coats.
1. Stain Coat: Acrylic latex solid color stain.
a. Moore: 610 ArborCoat Exterior Stain - Solid Ultra Flat.
b. Cabot: Cabot O.V.T. Solid Color Acrylic Stain.
c. PPG: Olympic Solid Color Acrylic Latex Base Stain.
d. S-W: A16, Woodscapes Exterior Solid Acrylic Stain.

3.07 INTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates, as indicated. Dry film thickness is noted as “DFT.” Provide compatibility test areas on existing painted substrates.

B. Concrete Masonry Units: Low-VOC Acrylic Satin Finish. 2 Coats over filler, with total DFT not less than 2.5 mils. (Provide for CMU except where “epoxy finish” is indicated.)
1. Filler Coat, 100% Acrylic. Apply filler coat at a rate to ensure complete coverage. Brush, spray or roller apply and back roll or squeegee for smooth, pinhole-free treatment.
a. Moore: 571 Ultra Spec Hi-Build Masonry Block Filler.
b. PPG: 16-90 Pitt Glaze WB Acrylic Interior Exterior Block Filler.
c. S-W: B46W150 Pro Industrial Heavy Duty Block Filler. (PrepRite not acceptable)

2. Waterproofing Filler Coat – Showers & Wet Applications: Cementitious resin or epoxy block filler applied by brush, spray or roller and back rolled or squeegeed for smooth, pinhole-free treatment.
   a. Moore: P31 Waterborne Epoxy Block filler.
   b. PPG: 95-217 Epoxy Ester Cementitious Waterproofing Block Filler.
   c. S-W: B42W400/B42V401 Kem Cati-Coat HS Epoxy Filler/Sealer.
3. Bonding Primer (previously painted): Acrylic bonding primer for exceptional adhesion to hard, glossy surfaces. Test for adhesion. Brush, spray or roller apply and back roll.
   a. Moore: Stix Bonding Primer.
   b. PPG: 17-921 PPG Seal Grip Acrylic Universal Primer/Sealer.
   c. S-W: B51W150 Extreme Bond Interior/Exterior Primer.
4. First & Second Finish Coats: Commercial Interior Low-VOC Acrylic Satin Finish. Provide for wall finishes unless directed otherwise.
   a. Moore: N538 Ultra Spec 500 Interior Eggshell Finish.
   b. PPG: 6-4300 Speedhide Zero VOC Interior Eggshell Latex.
   c. S-W: B20-12650 ProMar 200 Zero VOC Interior Latex Eg-Shel.

C. Concrete Masonry Units - Semi-Gloss Water-Borne Epoxy Finish: 2 Coats over filler:
1. Block Filler Coat: Acrylic-latex or as required by manufacturer for topcoat. Brush, spray or roller apply and back roll for smooth pinhole-free treatment.
   a. Moore: 571 Ultra Spec Hi-Build Masonry Block Filler.
   b. PPG: 6-15 Speedhide Int/Ext Acrylic Masonry Block Filler.
   c. PPG: 16-90 Pitt-Glaze WB Int/Ext Block Filler Latex.
   d. S-W: B46W150 Pro Industrial Heavy Duty Block Filler.
2. First and Second Coats: Two-component, semi-gloss water born polyamide epoxy enamel applied at a DFT of 1.5 to 4.0 mils per coat.
   a. Moore: Corotech V400 Polyamide Epoxy Coating.
   b. PPG: 98-100 Aquapon WB Water Base Epoxy – Semi-Gloss.
   c. S-W: B73V300 Pro Industrial Water Based Catalyzed Epoxy Hardener.

D. Concrete Floor with Gloss Acrylic Floor Enamel: 2 Coats over primer on cured surface. Concrete must cure a minimum of 30 days before painting and have pH of 10.0 or lower. Prepare per SSPC-SP13, shot blast or prepare floor by other means acceptable to paint manufacturer (accepted in writing) prior to painting.
1. Primer Coat: Acrylic primer, brush or roller applied over prepared concrete.
   a. Moore: 122 Moore's Latex Floor and Patio Enamel (thinned 1 pint/gallon).
   b. PPG: 3-510 Pittsburgh Floor, Porch & Deck Satin Latex.
   c. S-W: B90 Armorseal Tread-Plex.
2. First and Second Finish Coats: Gloss Acrylic Floor Enamel or comparable performance enamel. Provide 1.5 - 2.0 mils DFT per coat.
   a. Moore: 122 Moore’s Latex Floor and Patio Enamel.
   b. PPG: 3-510 Pittsburgh Floor, Porch & Deck Satin Latex.
   c. S-W: B90 Armorseal Tread-Plex.

E. Concrete Floor with Gloss Water-Base Epoxy Floor Enamel: 2 Coats over primer on cured surface. Concrete must cure a minimum of 30 days before painting and have pH of 10.0 or lower. Prepare per SSPC-SP13, shot blast or prepare floor by other means acceptable to paint manufacturer (accepted in writing) prior to painting.
1. Primer Coat: Epoxy primer, brush or roller applied over prepared concrete. Provide 1.5 - 2.0 mils DFT per coat or as recommended by manufacturer.

a. Moore: P41 Fast Dry Epoxy Floor Sealer/Finish.
b. PPG: 98-1 Series Aquapon WB Water Base Epoxy 2.0 mils to 3.0 mils DFT per coat.
c. S-W: B70-8100/B70V8100 Armorseal 8100 Water based Epoxy Floor Coating.

2. Two Finish Coats: Two-component waterborne catalyzed polyamide epoxy floor enamel or comparable performance enamel. Provide 1.5 - 2.0 mils DFT per coat or as recommended by manufacturer.
   a. Moore: P42 Waterborne Polyamide High Gloss Epoxy Enamel 2.0 mils to 3.0 mils DFT per coat.
   b. PPG: 98-1 Series Aquapon WB Water Base Epoxy 2.0 mils to 3.0 mils DFT per coat.
   c. S-W: B70-8100/B70V8100 Armorseal 8100 Water based Epoxy Floor Coating.

F. Concrete Floor with Epoxy Floor-Striping Enamel at Vehicle Bays: 2 Coats over primer on cured surface. Concrete must cure a minimum of 30 days before painting and have pH of 10.0 or lower. Prepare floor by means acceptable to paint manufacturer (accepted in writing) prior to painting.
   1. Primer Coat: Epoxy primer applied over prepared concrete.
      a. Moore: Corotech V155-00 100% Solids Epoxy Pre-Primer.
      b. PPG: Amerlock 2/400 Series primer.
      c. S-W: Macropoxy 646 Fast Cure (FC) Epoxy.
   2. Two Finish Coats: Two-component high solids epoxy floor enamel for traffic surface. Provide 4.0 - 8.0 mils DFT per coat or as recommended by manufacturer.
      a. Moore: Corotech V440 Waterborne Amine Epoxy.
      b. PPG: Amerlock 2.
      c. S-W: Macropoxy 646 Fast Cure (FC) Epoxy.

G. Gypsum Board Systems with Latex Finish: Satin (egg-shell) finish at walls and flat finish on ceilings except as indicated otherwise. Provide best commercial Low-VOC formulation with 0 VOC per EPA test method 24.
   1. Filler Coat: 0 VOC (per EPS test method 24) Latex Primer.
      a. Moore: N534 Ultra Spec 500 Interior Latex Primer.
      b. PPG: 6-4900 Speedhide Zero VOC Interior Latex Primer.
      c. S-W: B28-2600 ProMar 200 Zero VOC Interior Latex Primer.
   2. First & Second Finish Coats: Interior Low-VOC Acrylic Satin Finish. (Low lustre/Satin = 25-45% @60°) Provide for wall finishes unless indicated otherwise.
      a. Moore: N538 Ultra Spec 500 Interior Eggshell.
      b. PPG: 6-4300 Speedhide Zero VOC Interior Eggshell Latex.
      c. S-W: B20-12650 ProMar 200 Zero VOC Interior Latex Eg-Shel.
   3. First & Second Finish Coats: Interior Low-VOC Acrylic Flat Finish. Provide for ceiling applications unless indicated otherwise.
      a. Moore: N536 Ultra Spec 500 Interior Flat.
      b. PPG: 6-4100 Speedhide Zero VOC Interior Latex Flat.
      c. S-W: B30-2600 ProMar 200 Zero VOC Interior Latex Flat or B30-4650 ProMar 400 Zero VOC Interior Latex Flat.

H. Gypsum Board Systems with Water-Borne Polyamide Epoxy Finish (“EPX”):
   1. Filler Coat: Manufacturer’s recommended primer.
      a. Moore: 217 Fresh Start Alkyd Enamel Underbody.
      b. PPG: 6-2 Speedhide Interior Latex Sealer.
      c. S-W: B28W2600 ProMar 200 Zero VOC Primer.

2. First and Second Coats: Two-component, water born polyamide epoxy enamel applied at a DFT of 1.5 to 4.0 mils per coat. Provide semi-gloss finish unless directed otherwise.
    a. Moore: Corotech V440 Waterborne Amine Epoxy.
    b. PPG: 98-100 Aquapon WB Water Base Epoxy – Semi-Gloss.
    c. S-W: B73W360 / B73V300 Water Based Catalyzed Epoxy.

I. Ferrous Metal with Latex Dry Fog Finish: One finish coat over primed exposed construction. Provide nominal 50 square foot sample area to test for paint compatibility with substrates.
1. Prime Coat: (Acrylic or recommended VOC-compliant metal primer for surfaces not pre-primed.) 2.0 mils DFT.
    a. Moore: N110 Superkote 5000 DryFall Latex Flat.
    b. PPG: 90-712 Pitt-Tech Int/Ext Primer/Finish Industrial Enamel.
    c. S-W: B66-1300 Series Pro Industrial Pro-Cryl Universal Acrylic Primer.
2. Top Coat: All exposed structure as scheduled. Acrylic Dry Fog 3.0 mils DFT. Provide color finish as selected by Architect from manufacturer's full range.
    a. Moore: N110 Superkote 5000 DryFall Latex Flat.
    b. PPG: 6-724XI Series Speedhide Super Tech WB Int. Dry-Fog Flat Latex Flat.
    c. S-W: B42W1181 / B42B81 Waterborne Acrylic Dry Fall, Flat.

J. Ferrous Metal: Direct to Metal (“DTM”) Acrylic Enamel Finish: 2 Coats over primer, with total DFT not less than 2.5 mils. Provide satin finish at hollow metal steel doors and frames, and semi-gloss at other applications.
1. Prime Coat: Lead-free, acrylic base primer. Not required on shop primed items.
    a. Moore: HP29 Ultra Spec HP DTM Acrylic Semi-Gloss.
    b. PPG: 90-712 Pitt-Tech Int/Ext Primer/Finish Industrial Enamel.
    c. S-W: B66W11 Pro Industrial DTM Acrylic Primer/Finish (or B66 W200).
2. Bonding Primer (previously painted): Acrylic bonding primer designed for previously painted ferrous metal to ensure secure bond. Brush, spray or roller apply and back roll.
    a. Moore: SXA-110 Insl-X Waterborne Bonding Primer.
    b. PPG: 90-912 Pitt-Tech Plus DTM Industrial Primer.
    c. S-W: B66A50 DTM Bonding Primer.
3. First and Second Coat: DTM Acrylic Semi-Gloss Enamel. (30-40 units @ 60°)
    a. Moore: HP29 Ultra Spec HP DTM Acrylic Semi-Gloss.
    b. PPG: 90-1210 Pitt-Tech Int/Ext Semi-Gloss DTM Industrial Enamel.
    c. S-W: B66W1151 Pro Industrial DTM Acrylic Semi-Gloss Coating.
4. First and Second Coat: DTM Acrylic Satin Enamel. Provide for hollow metal steel doors and frames. (15-25 units @ 60°)
    a. Moore: HP25 Ultra Spec HP DTM Acrylic Low Lustre.
    b. PPG: 90-1110 Pitt-Tech Int/Ext Satin DTM Industrial Enamel.
    c. S-W: B66W1251 Pro Industrial DTM Acrylic Eg-Shel.

K. Zinc-Coated Metal: Semi-Gloss Direct to Metal (“DTM”) Acrylic Enamel Finish: 2 Coats over primer, with min. total DFT of 2.5 mils.
1. Prime Coat: Lead-free, acrylic base interior galvanized metal primer, premium grade.
    a. Moore: HP04 Ultra Spec HP Acrylic Metal Primer.
    b. PPG: 90-712 Pitt-Tech Int/Ext Primer/Finish Industrial Enamel.
    c. S-W: B66W1151 Pro Industrial DTM Acrylic Semi-Gloss Coating.
2. First and Second Coats: DTM Acrylic Semi-Gloss Enamel. Same as for ferrous metal.

L. Intumescent Mastic-Coated Metal: Semi-Gloss Direct to Metal (“DTM”) Acrylic Enamel Finish as approved by intumescent coating manufacturer: 2 Coats, with min. total DFT of 2.5 mils.

M. Painted Woodwork and Hardboard: Semi-Gloss Acrylic Enamel Finish: Two topcoats over undercoater. Provide at painted wood shelving, electrical panel boards, and as noted.
   1. Prime Coat: Interior Oil Undercoat.
      a. Moore: 024 Fresh Start Multi-Purpose Interior/Exterior Oil Based Primer.
      b. PPG: 17-941NF Seal Grip Int/Ext. Alkyd Universal Primer.
      c. S-W: B49 W8820 Multi-Purpose Oil-Based Primer.
   2. Prime Coat: Interior Latex Undercoat, for medium-duty, low-VOC formulation.
      a. Moore: N023 Fresh Start Multi-Purpose Latex Primer.
      b. PPG: 17-921 Seal Grip Int/Ext Acrylic Universal Primer.
      c. S-W: B28 W811 Premium Wall & Wood Primer.
   3. First and Second Finish Coats: DTM Acrylic Semi-Gloss Enamel. DFT 3.5 Mils min.
      a. Moore: HP29 Ultra Spec DTM Acrylic Semi-Gloss.
      b. PPG: 90-1110 Pitt-Tech Int/Ext Satin DTM Industrial Enamel.
      c. S-W: B66W1150 Series Pro Industrial DTM Acrylic Semi-Gloss Coating.
   4. First and Second Finish Coats: Premium Acrylic Semi-Gloss Enamel <150 g/L. DFT 3.5 Mils min.
      a. Moore: 551 Regal Select Semi-Gloss.
      b. PPG: 87-6 Manor Hall Interior Semi-Gloss Acrylic Latex.
      c. S-W: B31W20 ProClassic Waterborne.

N. Stained woodwork with transparent finish is specified in Division 6 Sections by woodworker.

END OF SECTION 099100

SECTION 101400
SIGNAGE

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.

B. ADA Standards - 2010 ADA Standards for Accessible Design.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Allowance: Interior and exterior panel signage shall be covered by allowance; refer to Section 012100 - Allowances.

B. Pre-Fabrication Meeting: The signage contractor shall meet with representatives of the Owner to develop a Signage Schedule, including signage style and layout, individual sign locations, including locations of code required signage and wayfinding signage, and final room naming and numbering. The Architect will provide the graphics contractor with reproducible floor plan drawings for use in determining sign locations.

1.03 SUBMITTALS

A. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

B. Signage Schedule (After Pre-Fabrication Meeting): Submit schedule with information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. Submit for approval by Owner through Architect prior to fabrication.

C. Selection Samples: Where colors are not specified, submit color selection charts or chips for each type of signage.

D. Verification Samples: Submit samples, manufacturer's standard size, showing selected colors for each type of signage.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.05 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most

comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Toilet room signage shall include pictograms and international symbol of accessibility.

2.02 PANEL SIGNAGE TYPES

A. General: Interior and exterior panel signage shall be provided via lump-sum allowance; refer to Division 1 Section "Allowances."

B. Manufacturers:
   1. Allen Industries Architectural Signage.
   2. APCO Graphics, Inc.
   3. ASI-Modulex, Inc.
   4. Best Sign Systems, Inc.
   5. Gemini Incorporated.
   6. Innerface Sign Systems, Inc.
   7. InPro Corporation.
   8. Matthews International Corporation, Bronze Division.
   9. Mohawk Sign Systems.
   10. Nelson-Harkins Industries.
   11. Seton Identification Products.
   12. The Supersine Company.
   13. Welch Sign.
   14. Substitutions: See Section 016000 - Product Requirements.

C. Photopolymer Panel Signage: Signage media without frame.
   1. Signage Material: 0.032-inch water wash photopolymer face layer over a 0.160-inch phenolic or 0.120-inch PETG base layer.
   2. Edges: Square.
   3. Corners: Square.
   4. Wall Mounting of One-Sided Signs: Tape adhesive.
      a. For signs mounted to glass, such as at door sidelights, provide a rear cover plate so the backside of sign will not be visible through the glass.
   5. Tactile Signage: Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.

D. Aluminum Panel Signage: Fabricate of minimum 0.063-inch aluminum sheet, without frame, with baked enamel finish. Wall mount with stainless steel fasteners in each corner. Not acceptable at locations requiring tactile signage.

E. Color and Font: Unless otherwise indicated, panel signage, font, and color shall be selected from manufacturer's full range.

F. Code-Required Signage: In addition to the room signage, provide panel signage required by accessibility regulations and requirements of authorities having jurisdiction, including, but not limited to, the following:
   1. Tactile exit signs, stairway identification signs, room maximum capacity signs, elevator signs, and accessible space signs.
   2. Refer to Division 26 and Electrical Drawings for illuminated exit signs.

2.03 PLAQUES

A. Manufacturers:
   1. Advance Corporation; Braille-Tac Division.
   2. A.R.K. Ramos.
   3. Gemini Incorporated.
   4. Matthews International Corporation, Bronze Division.
   5. Metal Arts; Division of L&H Manufacturing Co.
   6. Mills Manufacturing Company.
   7. Nelson-Harkins Industries.
   8. The Southwell Company.
   9. Substitutions: See Section 016000 - Product Requirements.

B. Metal Plaques:
   1. Metal: Bronze casting.
   2. Size: For bid purposes assume one 36 inch by 24 inch plaque, with a 6 inch diameter graphic logo / county seal (image to be provided by Owner) and raised text. Confirm final size and desired information, text, and typeface, with Owner.
   3. Surface Finish: Brushed, satin.
   4. Painted Background Color: As selected by Architect from manufacturer's standard background colors.
   5. Protective Coating: Manufacturer's standard clear coating.
   6. Mounting: Stud mounted, with concealed studs.

2.04 DIMENSIONAL LETTERS

A. Manufacturers:
   1. A.R.K. Ramos.
   2. ASI-Modulex, Inc.
   3. Charleston Industries, Inc.
   4. Gemini Incorporated.
   5. Innerface Sign Systems, Inc.
   6. Matthews International Corporation, Bronze Division.
   7. Metal Arts; Division of L&H Manufacturing Co.
   8. Mills Manufacturing Company.
   9. Mohawk Sign Systems.
   10. Superior Signs.
   11. Substitutions: See Section 016000 - Product Requirements.

B. Metal Letters:
   1. Metal: Aluminum casting.
   2. Letter Thickness: As indicated on drawings; if not indicated, provide as follows:
      a. 6 inches high or less: 1/2 inch thick.
      b. 7- to 11-inches high: 1 inch thick.
      c. 12- to 17-inches high: 1-1/2 inches thick.
      d. 18 inches high or more: 2 inches thick.
   3. Letter Height: As indicated on drawings.
   4. Text and Typeface: As indicated; where not indicated, as selected by Architect from manufacturer's full range of fonts.

5. Finish: Painted; color as selected by Architect from manufacturer's full range.
6. Mounting: Fabricate dimensional lettering for the following mounting types:
   a. Projected Wall Mounted: Cast studs into the back of each letter for wall mounting at location indicated. Studs shall be sized to extend through cladding and fasten to structural substrate. Provide for a 1/2-inch gap between back of letter and face of cladding. Do not mount directly flush to wall surface.

2.05 ACCESSORIES

A. Concealed Screws: Stainless steel, or other non-corroding metal.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
   1. Room Signs: Mount on latch side, with a clear space of 18 inches by 18 inches beyond the door swing arc, centered on the tactile characters. At double doors, mount to the right of right-hand leaf or on nearest adjacent wall. Mount at height that is compliant with ADA Standards.

D. Mounting:
   1. Projected Wall Mounted: Cast studs into the back of each letter for wall mounting at location indicated. Studs shall be sized to extend through cladding and fasten to structural substrate. Provide for a 1/2-inch gap between back of letter and face of cladding. Do not mount directly flush to wall surface.
   2. Flush Wall Mounted: Cast studs into back of each letter for mounting to wall. Mount flush to wall surface with no gap behind letters.

E. Mounting, Plaques:
   1. Mount plaques with manufacturer's standard concealed stud method; with anchors recommended specifically for wall/partition substrate structure indicated. Mount plaques flush to wall surface with no gap behind plaques.

F. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 101400

SECTION 102113.17
PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls.

1.03 SUBMITTALS

A. Product Data: Provide data on panel construction, hardware, and accessories.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

1. Include field measurements, and indicate where field measurements differ from documents.

1.04 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to fabrication and verify that dimensions and tolerances are acceptable for fabricated products to fit the space. Indicate field measurements on shop drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Toilet Compartments:

1. American Sanitary Partition Corporation.
2. ASI Accurate Partitions.
3. ASI Global Partitions.
4. Bobrick Washroom Equipment, Inc.
5. General Partitions Mfg. Corp.
6. Metpar Corp.
7. Partition Systems International of South Carolina (PSiSC).

2.02 PHENOLIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.

B. Doors: All door widths shall be clear widths with door open at 90 degrees.

1. Thickness: 3/4 inch.
2. Door Width (Standard Stalls): 24 inch, in-swinging.
3. Door Width (Ambulatory Stalls): 32 inch, out-swinging.
4. Door Width (Accessible Stalls): 36 inch, out-swinging.
5. Height: 58 inch.

C. Panels:

1. Thickness: 1/2 inch.

2. Height: 58 inch.

D. Pilasters:
1. Thickness: 3/4 inch.
2. Width: As required to fit space; minimum 3 inch.

2.03 ACCESSORIES

A. Material for Hardware and Accessories: Provide stainless steel or anodized aluminum as indicated, with satin finish. Where not indicated, Contractor may provide either material at its option. Zamac is not acceptable.
1. All hardware at out-swinging doors shall comply with accessibility regulations.

B. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.

C. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.

D. Wall and Pilaster Brackets: Natural anodized aluminum with minimum 0.125 inch wall thickness; continuous type.

E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

F. Hinges: Coordinate hinges with latch and keeper to provide emergency access.
1. Continuous (Piano) Hinges (Heavy-Duty): 3-inch-wide, continuous, 0.062-inch (16 gauge) thick stainless steel piano hinge with 1/8-inch stainless steel pivot pin. Provide spring-loaded self-closing type with five (5) adjustable internal springs at accessible, barrier-free, and outswing doors, and provide gravity type with cam knuckles that can be adjusted to hold doors open at inswinging doors. Hinge length shall be a maximum of 1 inch less than door height. Provide pre-drilled hinge leaves for mounting and stainless steel through-bolts; holes at 12 inches o.c.

G. Door Hardware: Coordinate latch and keeper with hinges to provide emergency access.
1. Door Latch (Heavy-Duty): Slide type, cast stainless steel with minimum 0.150-inch thickness slide bar, latch knob welded to slide bar.
2. Door Strike and Keeper with Rubber Bumper (Heavy-Duty): Cast stainless steel, minimum 2.5-inch high with minimum 0.125-inch wall thickness, with integral rubber bumper. Mount on pilaster in alignment with door latch.
3. Provide a door pull on both sides of door for accessible and ambulatory compartments, in compliance with the ADA Standards for Accessible Design.
4. Coat Hook with Rubber Bumper: One per compartment, mounted centered on inside face of door.
5. Rubber Door Bumper: Mount in upper corner on latch side of outswinging doors where door will impact wall in the open position.

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 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.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

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 102113.17

SECTION 102600
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies.

1.02 SUBMITTALS

A. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

B. Shop Drawings: Include plans, elevation, sections, and attachment details.

C. Selection Samples: Provide manufacturer's color charts for each product and material requiring color selection.

D. Verification Samples: Submit physical samples, manufacturer's standard size, for each selected color.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.03 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.

1.04 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner'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. Babcock-Davis.
2. Construction Specialties, Inc. (Basis of Design)
3. Inpro.
4. Koroseal Interior Products.
5. Nystrom, Inc.
6. Substitutions: See Section 016000 - Product Requirements.

B. Protective Wall Covering: **[IRWP-1]**
1. Construction Specialties, Inc; Acrovyn Woodgrains Collection. (Basis of Design)
2. Inpro.
3. MDC Interior Solutions; MDC Wall Protection - Duratec: www.mdcwall.com/#sle.
4. Pawling Corp.
5. Substitutions: See Section 016000 - Product Requirements.

C. Protective Wall Covering: **[IRWP-2]**
1. Construction Specialties, Inc; Acrovyn Textile Collection. (Basis of Design)
2. Inpro.
3. MDC Interior Solutions; MDC Wall Protection - Duratec: www.mdcwall.com/#sle.
4. Pawling Corp.
5. Substitutions: See Section 016000 - 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.

2.03 PRODUCT TYPES

A. Corner Guards - Surface Mounted:
1. Basis-of-Design Product: Construction Specialties; Acrovyn VA Series.
2. Material: Polyethylene terephthalate (PET or PETG); PVC-free.
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: 1-1/2 inches.
5. Corner: Square.
6. Color: To be selected by Architect from manufacturer's full range.
7. Length: One piece, 6 feet (72 inches) in length.

B. Protective Wall Covering:
1. Basis-of-Design: Construction Specialties; Acrovyn High Impact Wall Covering.
2. Material: Polyethylene terephthalate (PET or PETG); PVC and PBTs-free.
3. Thickness: 0.040 inch.
4. 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.
5. Color: To be selected by Architect from manufacturer's full range.
6. Accessories: Provide manufacturer's standard color-matched trim and moldings.

C. Adhesives and Primers: As recommended by manufacturer.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

2.05 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide wall and door protection systems of each type from a single source and manufacturer.

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.

1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

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. Provide corner guards at all outside corners of gypsum board partitions.

C. Position corner guard with bottom of corner guard immediately above top of wall base.

D. Position protective wall covering no less than 1 inch above finished floor to allow for floor level variation.

1. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
2. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
3. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
4. Use a roller to ensure maximum contact with adhesive.
5. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

A. See Section 017419 - 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 102600

SECTION 102800
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

E. ASTM C1036 - Standard Specification for Flat Glass.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

I. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.03 SUBMITTALS

A. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

B. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

C. Maintenance Data: For each type of accessory, to include in maintenance manual per Section 017800 - Closeout Submittals. Include list of replacement parts and service recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment.
   3. Bradley Corporation.

B. Under-Lavatory Pipe Supply Covers:
   1. Plumberex Specialty Products, Inc.
   2. Truebro; IPS Corporation.

C. Baby Changing Stations:

1. American Specialties, Inc.
2. Bradley Corporation.
3. Diaper Deck & Company.
4. Foundations Worldwide, Inc.
5. Koala Kare Products.
6. Safe-Strap Company, Inc.

D. 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.

B. Keys: Provide 6 master/universal keys, minimum, to Owner.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
   1. Provide mechanical attachment of all accessories. Use of adhesive or double-side tape is not acceptable.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 TOILET ACCESSORIES SCHEDULE, GENERAL

A. General: The following products make reference to the designations indicated on the Toilet Accessories Schedule, Toilet Assemblies, and toilet room plans on the drawings; herein designated as "TA-x".

2.05 COMMERCIAL TOILET AND BATH ACCESSORIES

A. Grab Bars (TA-A, B, & C): Stainless steel, smooth surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Finish: Satin.
      d. Length and Configuration: As indicated on drawings.
      e. Products:
         1) American Specialties, Inc.; 3700 Series.
         2) Bobrick Washroom Equipment, Inc.; B-5806 Series.
         3) Bradley Corporation; 832 Series.

B. Toilet Paper Dispenser (TA-D): Roll-in-reserve type, designed to allow automatic activation of reserve roll when needed, or manual activation by pressing release bar, surface-mounted, stainless steel unit with pivot hinge, tumbler lock.
   1. Products:

a. American Specialties, Inc.; Model 20030.
b. Bobrick Washroom Equipment, Inc.; Model B-4288.
c. Bradley Corporation; Model 5402.

C. Sanitary Napkin Disposal Unit (TA-E): Stainless steel, surface-mounted, self-closing door, with full-length stainless steel piano-type hinge, removable receptacle.
1. Products:
a. American Specialties, Inc; Model 20852.
b. Bobrick Washroom Equipment, Inc.; Model B-270 Contura.
c. Bradley Corporation; Model 4781-11.

D. Soap Dispenser (TA-F): Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and vertical stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
1. Minimum Capacity: 40 ounces.
2. Products:
a. American Specialties, Inc.; Model 0347.
b. Bobrick Washroom Equipment, Inc.; Model B-2111.
c. Bradley Corporation; Model 6562.

E. Mirrors (TA-G): Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
2. Size: As indicated on drawings.
3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
4. Products:
a. American Specialties, Inc; 0600 A Series.
b. Bobrick Washroom Equipment, Inc.; Model B-290.
c. Bradley Corporation; Model 780.

F. Combination Towel Dispenser/Waste Receptacle (TA-R): Recessed flush with wall, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.
1. Waste receptacle liner: Provide with manufacturer's reusable, molded plastic liner accessory with stainless steel support strap. Bobrick "LinerMate" or equivalent.
2. Towel dispenser capacity: 475 multi-fold; 300 C-fold.
3. Waste receptacle capacity: 2 gallons.
4. Products:
a. American Specialties, Inc; Model 0462-AD.
b. Bobrick Washroom Equipment, Inc; Model B-369.
c. Bradley Corp; Model 2291.

G. Robe Hook: Heavy-duty stainless steel, double-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish. Provide one centered on interior face of door of all single-user toilet rooms, unless otherwise indicated on Drawings; verify final mounting locations with Architect in field.
1. Products (Double-Prong):
a. American Specialties, Inc.; Model 7345.
b. Bobrick Washroom Equipment, Inc.; Model B-7672.
c. Bradley Corporation; Model 9124.

2.06 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers:
   1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
   2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
   3. Construction: 1/8 inch flexible PVC.
      a. 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.
      b. Microbial and Fungal Resistance: Comply with ASTM G21.
   4. Color: White.
   5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
   6. Products:
      a. Plumberex Specialty Products, Inc; Plumberex Trap Gear.
      b. Truebro; IPS Corporation; Lav Guard 2.

2.07 BABY CHANGING STATIONS

A. Baby Changing Station (TA-J): Wall-mounted folding baby changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
   1. Material: Polyethylene.
   2. Mounting: Surface.
   3. Color: As selected.
   4. Minimum Rated Load: 250 pounds.
   5. Products:
      a. American Specialties, Inc; Model 9014.
      b. Bradley Corp; Model 9632.
      c. Diaper Deck & Co.; Diaper Deck.
      d. Foundations Worldwide; Classic Horizontal Wall Mounted Changing Station
      e. Koala Kare Products, Div. of Bobrick; KB300.
      f. Safe Strap Company, Inc; Diaper-Depot Basic.

2.08 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder (TA-T): 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
   1. Drying rod: Stainless steel, 1/4 inch diameter.
   2. Hooks: Three, 0.06 inch stainless steel rag hooks at shelf front.
   3. Mop/broom holders: Four spring-loaded rubber cam holders at shelf front.
   4. Length: 36 inches.
   5. Products:
      a. A&J Washroom Accessories, Inc.; Model UJ41B.
      b. American Specialties, Inc; Model 1315-4.
      c. Bobrick Washroom Equipment, Inc.; Model B-224 x 36.
      d. Bradley Corporation; Model 9984.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 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 on Drawings.

3.03 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 102800

SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide.

B. NFPA 10 - Standard for Portable Fire Extinguishers.

C. UL (DIR) - Online Certifications Directory.

1.02 SUBMITTALS

A. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and trim and door panel styles.

B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.03 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

B. Coordinate rough opening sizes to ensure cabinet locations meet ADA mounting requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers and Cabinets:
   1. Activar Construction Products Group, Inc. - JL Industries.
   2. Amerex Corporation.
   3. Ansul, a Tyco Business.
   4. Babcock-Davis.
   5. Badger Fire Protection.
   6. Buckeye Fire Equipment Company.
   7. Fire-End & Croker Corporation.
   8. Kidde, a unit of United Technologies Corp.
   9. Modern Metal Products; Div of Technico.
   10. Larsen's Manufacturing Co.
   11. MOON American.
   12. Nystrom, Inc.
   13. Oval Brand Fire Products.
   14. Potter-Roemer.
   15. Pyro-Chem, a Tyco Business.
   16. Strike First Corporation of America.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: 4-A: 60-B:C.
   2. Size: 10 pound.
   3. Finish: Baked polyester powder coat, color as selected.
   4. Temperature range: Minus 40 degrees F to 120 degrees F.

C. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
   1. Class: K type.
   2. Size: 1.6 gallons.
   3. Temperature range: Minus 20 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.
   1. Formed cold-rolled steel sheet; minimum 0.036 inch thick base metal.
   2. Available Products: One of the following, or comparable product by manufacturer from list above:
      a. J.L. Industries/Activar; Ambassador 1017.
      b. Larsen's Manufacturing Co.; Model 2409-6R.
      c. Potter-Roemer; Model 1724.

B. Cabinet Configuration: Semi-recessed type.
   1. Size to accommodate extinguisher(s) and accessories indicated.
   2. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
   3. Trim Type: One piece trim and door frame, returned to wall surface. Rolled edge trim; 2-1/2- to 3-inch depth as standard with manufacturer.
   4. Door Glazing Style: Vertical duo, configuration as standard with manufacturer.

C. Door: Minimum 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge.

D. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Operating Hardware: Manufacturer's standard for cabinet type; continuous door hinge allowing 180 degree opening, with ADA-compliant door latch either surface mounted or flush inset into door panel, with cam or friction latch operation.

G. Fabrication: Weld, fill, and grind components smooth.

H. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.

I. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated or baked-enamel finish.

B. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, pre-spaced lettering in accordance with authorities having jurisdiction (AHJ).
   1. Apply vertically to door of fire extinguisher cabinets, and apply to wall surface at bracket mounted extinguishers.

2.05 EMERGENCY KEY ACCESS BOX

A. Commercial Door Key Access Box: Provide fire department emergency key access box manufactured by The Knox Company; as required by local Fire Marshal. Provide Knox Box recessed mount 3200 Series, nominal 4 inches by 5 inches by 3-1/4 inches deep, with tamper switch and recessed mounting kit. Provide manufacturer's standard polyester powder coat finish in black color. No substitutions will be considered. Coordinate recessed installation with substrate construction, electrical connections as required for proper operation, and with requirements of local Fire Marshal. Contact Knox Company: www.knoxbox.com

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, no greater than 48 inches from finished floor to top of handle.

C. Install mounting brackets at 44 inches above finish floor.

D. Secure rigidly in place.

E. Place extinguishers and accessories in cabinets and on wall brackets.

F. Adjust cabinet doors after installation to ensure smooth operation.

3.03 PROTECTION AND CLEANING

A. Protect fire extinguishers, fire extinguisher cabinets, and accessories from damage until Substantial Completion.

B. Provide touchup to damaged finishes; replace items that cannot be satisfactorily repaired or refinished.

END OF SECTION 104400

SECTION 107300
PROTECTIVE COVERS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

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

F. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

1.02 SUBMITTALS

A. Metal Product Data: Product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, footings, anchorage, size and type of fasteners, accessories and locations.

1. Shop drawings shall be project specific; manufacturer's standard details are not acceptable.
2. For protective covers indicated to attach to the building, include detail showing project-specific wall attachment detail that will transfer structural loads to the primary structural element of the exterior wall.

C. Selection Samples: Manufacturer's color charts for metal components.

D. Verification Samples: Manufacturer's standard size physical samples, representing actual material and finish of exposed metal, for each color selected by Architect.

E. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

F. Designer's qualification statement.

G. Specimen warranty.

1.03 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.04 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer's Warranty: Provide standard 1-year warranty covering all material deterioration, structural failure, and installation defect.

C. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of factory-applied finishes. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design (Building Mounted): Mapes Architectural Products; Super Lumideck - Hanger Rod.

B. Basis-of-Design (Column Supported): Mapes Architectural Products; Post Supported Walkway Canopy.

C. Acceptable Comparable Manufacturers:
   1. Architectural Fabrication, Inc.
   2. Dittmer Architectural Aluminum.
   3. Mitchell Metals.
   4. Perfection Architectural Systems, Inc.
   5. Superior Mason Products, LLC.
   6. Tennessee Valley Metals.
   7. Substitutions: See Section 016000 - Product Requirements.

2.02 PROTECTIVE COVERS - GENERAL

A. Design Criteria: Design and fabricate to resist gravity, wind, snow, ponding water, weather exposure, seismic, and other structural loads without failure, damage, or permanent deflection in accordance with ASCE 7, applicable building code, and as indicated on Drawings.
   1. Structural Design:
      a. Post-Supported: Coordinate foundations and footing design with Division 3 Section "Cast-in-Place Concrete" and with Structural Drawings.
      b. Building-Mounted: Provide engineered wall anchorage system capable of transferring structural loads to the structural CMU wythe or structural cold-formed steel framing (CFSF-S) of the exterior wall assembly. Do not support protective covers directly from brick veneer or other non-structural exterior claddings.
   2. Thermal Movement: Design protective covers to accommodate thermal movement caused by ambient temperature range of 120 degrees F and surface temperature range of 180 degrees F without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.

B. Configuration: Column layout, dimensions, clearances, and design as indicated on drawings.
   1. Drainage Concept (Post Supported): Water collected in decking conducted into perimeter drain beams and discharged through columns. Design drainage system to discharge water at grade level with internal diverter plates and cutouts in column sidewalls Discharge water either at grade level with diverter plates and column cutouts, or coordinate with subdrainage installer for connection into underground subdrainage system, as indicated on Drawings.
   2. Drainage Concept (Building-Mounted): Water collected in decking shall run to rear of protective cover into aluminum fascia/channel. Provide 2-inch diameter drain hole at one end of protective cover, with 3-inch by 3-inch downspout fabricated of smooth extruded aluminum. Downspout shall be fastened to wall with straps at minimum 60 inch on center. Downspouts shall drain on grade with splash block or into underground drainage, as indicated. Downspout and wall straps shall be finished to match protective cover.

C. Provide a complete system ready for erection at project site.

D. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.

2.03 PROTECTIVE COVERS - ASSEMBLY

A. Description: Flat top metal framework with metal covering supported by metal columns or hanger-rod assembly, as indicated.

B. Column Anchorage: Column embedded in concrete footing. Provide column sleeves or Styrofoam blockouts for presetting into concrete formwork.

C. Framework: Aluminum.

D. Covering Materials:
   1. Manufacturer's standard interlocking extruded aluminum decking modules.

2.04 COMPONENTS

A. Components for Post-Supported Protective Covers:
   1. Columns: Extruded aluminum; minimum wall thickness of 0.125 inch.
      a. Type: Box tube column.
      b. Cross-Section: 4 inches by 4 inches (per basis-of-design), unless otherwise indicated, or unless larger column size is required due to structural engineering analysis.
      c. Grout Key: Provide two 1-1/2 inch diameter holes on opposite sides in column base.
   2. Beams: Extruded aluminum; minimum wall thickness 0.125-inch.
      a. Style: U-shaped drain beams.
      b. Beam Depth: 7 inches (per basis-of-design), unless otherwise indicated, or unless larger size is required due to structural engineering analysis.
      c. Beam Width: Match nominal dimension of column width as required to allow for manufacturer's standard attachment method.
   3. Extruded Aluminum Decking: Self-flashing, interlocking sections; minimum 0.078-inch thick.
      a. Deck Profile: Manufacturer's standard deck section for corrugated soffit profile; size deck depth for structural spacing indicated.
   4. Fascia: Extruded aluminum; height per manufacturer's standard profile; minimum 0.125-inch thickness.
   5. Wall Attachment for Cantilever Type Post-Supported Canopies: Provide threaded rod anchors, extending fully through exterior wall. Provide integral eyebolt, "U" bracket, or manufacturer's standard clevis assembly at rod attachment anchors for hanger rod attachment. At all through anchors, provide galvanized steel compression sleeves, sized to wall cavity and cladding depth, and additional construction as needed to prevent transferring structural loads onto veneer/cladding. All loads shall transfer to structural "backup" wall.
      a. The structural system above is per the Basis-of-Design product indicated. Manufacturer may submit an alternate pre-engineered structural system, provided the system complies with other requirements of this section and is capable of supporting loads from the primary wall structure.

B. Components for Building-Mounted Protective Covers:
   1. Beams: Extruded aluminum.
      a. Style: I-shaped beams; 3-1/4" x 3-1/4" x 1/4" nominal.
   2. Extruded Decking: Self-flashing, interlocking sections, minimum 0.078-inch thick.
      a. Deck Profile: Manufacturer's standard deck section for corrugated soffit profile; size deck depth for depth of protective cover as indicated.

3. Fascia: Extruded aluminum; height per manufacturer's standard profile; minimum 0.125-inch thickness.
4. Hanger Rod Assembly: Manufacturer's standard 1-inch diameter hanger rod assembly, fabricated of schedule 40 galvanized steel. Provide aluminum clip angle bolted to aluminum I-beams for attachment of hanger rod assembly to canopy, with neoprene washers or other material standard to manufacturer for separation of dissimilar metals.
    a. Wall Attachment: Provide threaded rod anchors, extending fully through exterior wall. Provide integral eyebolt, "U" bracket, or manufacturer's standard clevis assembly at rod attachment anchors for hanger rod attachment. At all through anchors, provide galvanized steel compression sleeves, sized to wall cavity and cladding depth, and additional construction as needed to prevent transferring structural loads onto veneer/cladding. All loads shall transfer to structural "backup" wall.
        1) The structural system above is per the Basis-of-Design product indicated. Manufacturer may submit an alternate pre-engineered structural system, provided the system complies with other requirements of this section and is capable of supporting loads from the primary wall structure.

C. Exposed Framing Fasteners: Flush countersunk stainless steel screws or bolts; consistent with design of system and acceptable to manufacturer.
    1. Decking Fasteners: Stainless steel with neoprene washers.
    2. Finish exposed fasteners to match metal framing.

D. Flashings: Metal and finish matching system framing components, with thickness as recommended by manufacturer for conditions encountered.

E. Reinforcement Materials and Bracing: Where light fixtures, dimensional letter signage, or other items are indicated to be mounted to the protective cover, provide additional reinforcing or bracing elements to ensure a secure attachment to the protective cover without failure of decking or structural elements. Coordinate with submitted manufacturer(s) of items to be mounted to protective cover for loading requirements and attachment methods.

2.05 MATERIALS

A. Aluminum:
    1. Aluminum Extrusions: Alloy and temper 6063-T5, 6063-T6, or 6061-T6 members complying with ASTM B221 (ASTM B221M), with minimum thickness 1/8 inch for structural members and 1/16 inch for nonstructural members.

B. Concrete for Footings: Refer to Division 3 Section "Cast-in-Place Concrete."

C. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
    1. Grout: Comply with ASTM C1107/C1107M.

D. Bituminous Coating: ASTM D 1187 asphaltic coating or comparable protective coating to prevent corrosion between materials. Building felt is not acceptable.

2.06 FABRICATION - METAL COMPONENTS

A. Fit and shop assemble components in largest practical sizes, for delivery to site.

B. Fabricate components with joints tightly fitted and secured.

C. Provide notches, cut outs, and internal deflectors in members as noted to act as internal water drainage system.

D. Weld aluminum members in accordance with AWS D1.2/D1.2M.

E. Exposed Fastenings: Unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of framing. Fabricate anchors and related components of same material and finish as framing, except where specifically noted otherwise.

G. 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.

H. Accurately form components to suit each other and to building structure.

2.07 FINISHES

A. High Performance Organic Coatings: AAMA 2604, multiple coats, thermally cured fluoropolymer system.

B. Finish Color: To be selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Verify that foundation, electrical utilities, and placed anchors are in correct position.

C. Verify that bearing surfaces are ready to receive this work.

D. Do not proceed with installation until conditions are satisfactory.

3.02 PREPARATION

A. Supply items required to be cast into concrete with setting templates for installation of work in other sections.

B. Concrete Foundations/Footings: Coordinate with and provide column sleeves or Styrofoam blockouts to the concrete installer to ensure foundations comply with manufacturer's requirements.

3.03 INSTALLATION - FRAMING

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects.

C. Post Supported Canopies: Anchor columns in concrete foundations with column sleeves or preset Styrofoam blockout locations. Insert columns into foundation space and fill remaining annular space between concrete and columns with non-shrink cementitious grout. Wipe off surplus anchoring material, provide 1/8-inch build up at column and slope smoothly away from column. Seal anchoring material when required by grout manufacturer's installation instructions.

D. Building Mounted Canopies: Provide threaded anchor assemblies required for connecting framing to structure. Anchor framing to primary structural wall elements. Where primary structure of exterior wall is cold-formed steel framing (CFSF-S metal studs), provide additional fire-retardant treated wood blocking between metal stud members to accommodate hanger rod spacing.

E. Protective Coating: Provide a protective coating to separate aluminum surfaces from masonry, concrete or cementitious materials, and dissimilar metals.

3.04 INSTALLATION - METAL COVERING

A. Install in accordance with manufacturer's instructions.

B. Fasten metal decking to metal support members, aligned level and plumb.

C. Install fascia panels, trim, and flashing.

D. Separate dissimilar metals using concealed bituminous paint.

E. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.05 TOLERANCES

A. Maximum Variation from Plumb, Level, or Line: 1/8 inch per 10 feet, or 3/8 inch total in overall dimension.

B. Alignment of Two Adjoining Members Abutting in Plane: Within 1/16 inches.

3.06 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean all exposed surfaces after installation.

3.07 PROTECTION

A. Touch-up, repair, or replace damaged components before Date of Substantial Completion.

B. Protect protective covers after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION 107300

SECTION 107500
FLAGPOLES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.

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

C. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

D. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles.

1.02 SUBMITTALS

A. Product Data: Provide data on pole, accessories, and configurations.

B. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

C. Designer's Qualification Statement.

1.03 QUALITY ASSURANCE

A. Designer Qualifications: Design flagpole assemblies, including foundations, under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed the State in which the Project is located.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:
   1. American Flagpole & Flag Co.
   2. Baartol Co., Inc.
   3. Concord American Flagpole.
   4. Eagle Mountain Flag and Flagpole.
   5. Eder Flag Manufacturing Co., Inc.
   6. Morgan-Francis Flagpoles & Accessories
   7. Pole-Tech Co, Inc.
   8. Substitutions: See Section 016000 - Product Requirements.

2.02 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001.
   1. Material: Aluminum.
   2. Design: Cone tapered.

3. Mounting: Ground mounted type.
4. Quantity and Nominal Heights: As indicated on Drawings; heights shall be measured from nominal ground elevation.
5. Halyard: External type.
   a. Provide one halyard at each flagpole.
   b. Snap Hooks: Provide two snap hooks per halyard; fabricated of brass.

B. Performance Requirements:
1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.03 POLE MATERIALS

A. Aluminum: ASTM B241/B241M, 6063 alloy, T6 temper.

2.04 ACCESSORIES

A. Finial Ball: Aluminum, 6 inch diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Cleats: 9 inch size, aluminum with galvanized steel fastenings, one per halyard.

D. Halyard: 5/16 inch diameter nylon, braided, white.

E. Lights: Provide down lighting, mounted to top of each flagpole in lieu of finial ball. Lights shall be LED a maximum of 20 watts each, a minimum of 700 lumens, and shall be complete with all internal wiring. Lighting control shall be mounted at 8’-0” above ground level. Basis-of-Design Product: “Downlight Dome” by Eagle Mountain Flag and Flagpole.

2.05 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gauge, 0.0598 inch steel, galvanized, depth as indicated on Drawings.

2.06 FINISHING

A. Metal Surfaces in Contact With Concrete: Protect with bituminous/asphaltic coating.

B. Concealed Steel Surfaces: Galvanized to ASTM A123/A123M requirements.

C. Aluminum: Mechanical finish; medium satin directionally textured (AA-M32).

D. Finial: Spun finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

A. Install flagpole and fittings in accordance with manufacturer's instructions.

B. Electrically ground flagpole installation with ground spike and plate.

C. Fill base around foundation tube sleeve with concrete specified in Section 033000.

D. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

E. Fill foundation tube sleeve with sand and compact.

F. Seal around top of foundation tube sleeve with two inches of elastomeric sealant.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1 inch.

3.05 ADJUSTING

A. Adjust operating devices so that halyard functions smoothly.

END OF SECTION 107500

SECTION 111400
PEDESTRIAN CONTROL EQUIPMENT

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. NAAMM AMP 500-06 - Metal Finishes Manual.

C. NFPA 70 - National Electrical Code.

D. UL (DIR) - Online Certifications Directory.

E. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.02 SUBMITTALS

A. Product Data: Provide material descriptions, dimensions, and finishes for specified pedestrian control equipment.

B. Shop Drawings: Provide plans, installation requirements, and any required attachments to this work.

1. Identify standard and handicapped accessible lane dimensions and locations, and mounting of card readers.

C. Samples: Submit manufacturer's finish charts for color selections.

D. Operation and Maintenance Data: For system and equipment specified include model cut sheet, application manual, and user's guide for inclusion in project operation and maintenance manuals.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Coordinate schedule for delivery of units to site when installation is ready to commence.

B. Store units on pallets, as delivered, in upright position, and following instructions on packaging.

C. Store units in a dry interior location with temperature, humidity, and dust control.

1.04 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer agrees to correct defective work within 18 month period from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 WAIST-HIGH TURNSTILES

A. Waist-High Turnstiles Manufacturers:

1. Alvarado Manufacturing Company, Inc.
2. Boon Edam.
3. Controlled Access Turnstiles.
4. dormakaba.
5. Hayward Turnstiles, Inc.
6. ZKTeco USA.
7. Substitutions: See Section 016000 - Product Requirements.

B. Lane Configuration:
   1. Refer to drawings for lane configurations.
   2. Lane Width:
      a. Standard: Clear opening of 28 inch, minimum.
      b. Barrier-Free Access: Clear opening of 36 inch, minimum, and in compliance with ADA Standards.

C. Cabinet Style: Round ends.
   1. Barrier Type (Standard): Rotating barrier arms (tripod/3-arm style), electric lock control.
      a. Material: Stainless steel tube, No. 4 satin finish.
      b. Barrier Height: 34-1/8 inch.
   2. Barrier Type (ADA/Barrer-Free): Swing gate fabricated either with stainless steel tube with rounded end, or as a framed glass swing panel; as standard with manufacturer.
   3. Cabinet Width: Approximately 8 to 10 inches, nominal.
   4. Cabinet Length: Approximately 34 to 36 inches, nominal.
   5. Cabinet Height: Approximately 38 to 40 inches, nomnial.
   6. Cabinet Cladding Material: Stainless steel, Type 304 alloy, No. 4 satin finish.
   7. Cabinet Tops: Solid surfacing, material and color as selected by Architect.
   8. Internal Frame: Welded steel, with exterior welds ground smooth and concealed fasteners used with cladding material.

D. Operating Mechanism: Cast stainless steel ratchet assembly with precision type sealed bearings.
   1. Provide stainless steel tube turnstile arm with No. 4 satin finish and anchored into head of ratchet assembly.
   2. Provide solid aluminum head for attachment of turnstile arms, with clear anodized finish.
   3. Provide hydraulically dampened self-centered rotation, so when locked arms are disengaged they will rotate to next arm, self-center, and re-engage with ratchet assembly.

E. Card Readers: Install access control card readers, mounted on cabinets. Refer to Division 28 Access Control for additional requirements.
   1. Mounting Location: Surface mounted on top face of cabinet.

F. Electric Lock Operational Control: Provide electric lock control of turnstile for each direction of turnstile rotation in compliance with UL 325.
   1. Upon receiving authorization signal from access control system or push button device, turnstile will unlock and allow single user passage in selected direction, and turnstile will reset after user has passed through or within designated time period if passage does not occur. Refer to Division 28 for access control system information.
   2. Locking/Unlocking Operation: Provide independently controlled solenoid/spring assembly that moves turnstile arms into the "locked" or "unlocked" position.
      a. If user places forward pressure on arm during activation, turnstile arm will unlock when this pressure is removed within designated time period.
      b. Provide continuous-duty rated solenoids activated with 12 VDC and held in place using 6 VDC holding current; one per direction of operation
      c. Provide manual mechanical key override for each direction of turnstile rotation to override access control system.
   3. Power Requirements:
      a. Provide fuse protected junction box inside turnstile with 110 VAC or 220 VAC primary power, and on/off switch that turns on "Green" LED light when in "On" position.

b. Comply with system manufacturer's recommended power conductor size and length requirements and NFPA 70.
c. Provide UL (DIR) certified transformer attached to junction box that steps down primary power to 12 VDC low voltage operation.
d. Provide turnstile that is fail-safe upon loss of power supply, in electrically controlled directions.

G. Battery-Powered Counter: Provide lithium battery powered seven digit liquid crystal display (LCD) counter to maintain count of each turnstile arm rotation for each direction, and includes key to reset counter to "zero".

2.02 FINISHES

A. Comply with NAAMM AMP 500-06 for recommendations regarding applying and designating finishes.

B. Stainless Steel: No. 4 satin finish.

C. Appearance of Finished Work:
1. Noticeable variations in same piece are not acceptable.

D. Stainless Steel Finishes:
1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
3. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, installation areas and conditions for compliance with requirements for installation tolerances, and other conditions affecting performance of this work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install pedestrian control equipment in accordance with manufacturer's instructions.

B. Coordinate installation with access control systems. Refer to Division 28 sections.

C. Install pedestrian control equipment at locations and with spacing as indicated on drawings.

D. Provide width for barrier-free access at designated lanes in compliance with ADA Standards.

E. Power & Access Control Conduit: Coordinate power and communication conduit requirements for integrating pedestrian control equipment with access control system, refer to electrical and communications for additional requirements.
1. Coordinate conduit locations with equipment layout requirements.

3.03 CLEANING

A. Clean pedestrian control equipment and work areas carefully after installation to remove excess caulk, dirt and labels.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Location: At project site.

END OF SECTION 111400

SECTION 111900 - DETENTION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUMMARY

A. Detention Equipment Contractor (DEC):
   1. Provide the Detention Equipment indicated on the Drawings, in schedules, and as specified in this section.
   2. Types of Detention Equipment:
      a. Detention Mirror, Single & Double
      b. Detention Swing Stool, wall-mounted
      c. Detention Floor-mounted Bench
      d. Hopper Pass
      e. Tilt Drawer Pistol Locker, Surface Mount
      f. Recessed Toilet Paper Roll Holder
      g. Stainless Steel Counters and Work Shelves
      h. Detention Grab Bars, Anti-Ligature
      i. Wall Embed Plates for detention grab bars
      j. Key Cabinet is specified in Section 111960
   3. Refer Division 22 Section "Security Plumbing Fixtures" for detention equipment provided in and/or as part of the construction of cabinet showers, including, but not limited to, wall-mounted grab bars and stainless steel shower seats.
   4. Furnish to the General Contractor, for installation, all embedded anchors for Detention Equipment.
   5. Coordinate installation of the embedded items and the actual detention equipment with the appropriate Contractors.
   6. Coordinate with the Security Control System Contractor (SCSC), as described in Section 285000.

B. General Contractor:
   1. Install embedded anchors for Detention Equipment in accordance with manufacturer's and detention equipment subcontractor's shop drawings.
   2. Coordinate installation of embedded items with the DEC.

1.3 QUALITY ASSURANCE

A. The Detention Equipment Contractor (DEC) shall provide all detention equipment, shop drawing submittals, testing reports, and samples as described in Specification Sections 111900, 111910, 111950, and 111960. The DEC shall coordinate the work of all these specification sections with his various equipment manufacturers, fabricators, installers, and, also, with work by others. Questions on the Detention Work shall be directed to the DEC before being directed to the General Contractor, Architect, or Owner.

B. Available Detention Equipment Contractors (DEC):

1. Cornerstone Detention
   Decatur, AL 35601
2. Montgomery Technology Systems
   Greenville, AL 36037 & San Antonio, TX 78219
3. Pauly Jail Building Company
   Noblesville, IN 46062
4. CML Security, LLC
   Broomfield, CO 80023
5. Noah Detention Construction, LLC
   Niceville, Florida 32578
6. ESITECH Inc.
   Richmond, VA 23294

1.4 DETENTION EQUIPMENT CONTRACTOR'S (DEC) QUALIFICATIONS

A. It is critical that the Detention Equipment meets the requirements of the Contract Documents and that the equipment and/or systems be properly installed and functioning correctly by the Time of Completion specified.

B. A specialty DEC is required for this project. Refer to Sections 111900, 111910, 111950, and 111960 for scope of work.

C. It is not, however, the intent of the Owner or Architect to unfairly restrict competition. Other equally competent DECs who meet the 'qualification criteria' specified herein shall be added to the list of 'Available Detention Equipment Contractors (DEC)' by addendum.

D. All competent non-listed DECs may request to be listed by submitting the data requested in the Qualification Criteria, a minimum of fifteen (15) days prior to bid receipt date.

E. All other competent DECs will be listed in an addendum. Verbal approval will not satisfy this requirement. Grounds for disqualification shall exist if, in the opinion of the Architect, the information submitted is inaccurate or does not comply with the requirements of this specification. There will be no exceptions.

F. QUALIFICATION CRITERIA FOR THE DEC: It is critical that the Detention Equipment meets the requirements of the Contract Documents and that the equipment and systems be properly installed and functioning correctly by the Time for Completion specified for the project. Therefore, the DEC must meet the following qualification criteria:

1. Perform at least 50 percent of the Work (on-site installation) with its employees. Submit payroll record of executing project installation labor with a minimum of 50 percent of labor performed by direct employees of the DEC Company.
2. Provide a narrative of the history of the company from inception; including history of ownership, partnership, incorporation and/or other organizational information. Include information on the growth of the firm over time to include number of employees, relocation(s) of the firm, major production equipment purchases and replacements. Use only the current corporate/business entity, intending on bidding and performing the work.
3. Provide a statement that the firm has been in business under its current name for minimum of ten (10) continuous years.
4. Provide a list of all employees in supervisory positions stating their area of responsibility and their years of experience in that position.
   a. Number of years as a full-time employee of the DEC
   b. Number of years of jail experience
   c. Completed training program for iron workers (if involved in equipment installation)

5. Submit a complete list of all projects completed under the DEC's current name. Specifically highlighting projects completed in NC, SC and VA, including:
   a. Project Name, Owner, Contact Name, Address, and Phone Number
   b. Architect/Engineer of Record Name, Address, and Phone Number
   c. General Contractor or Construction Manager Name, Address, and Phone Number
   d. Total Amount of the DEC's Contract and Completion Date
6. Submit a listing of all jobs in which the DEC is presently and has been involved in litigation and the status thereof.
7. Provide a list of all jobs that your firm has been involved in liquidated damages or delay damages were filed against your firm.
8. Submit a letter of intent to test each detention door as described in Section 111910.
9. Submit for approval the name of the detention equipment manufacturers you intend to purchase from. Submit a current letter from the detention hardware manufacturer stating that the DEC is factory trained, fully authorized distributor and installer of their complete line of products.
10. Provide signed statement that DEC has not been found guilty of charges relating to conflicts of interest or to any criminal activity relating to construction methods, bidding, bid rigging, or bribery in the past five years.
11. Provide signed statement that DEC has not been found guilty of charges relating to employment of illegal aliens on construction projects in the last five (5) years.
12. Provide a letter from 'A' rated surety company that your company will be able to provide a 100 percent Performance/Payment bond for this project if awarded the project, but not less than $3 million dollars.
13. Provide a financial statement for the most recent fiscal year.

1.5 ACTION SUBMITTALS

A. A shop drawing submittal review meeting shall be held and coordinated by the General Contractor within two weeks after submittal. All participants should have at least two (2) weeks' worth of review of this first Shop Drawing submittal and be prepared to comment on its appropriateness for their assigned job efforts. The meeting shall last no longer than one (1) eight-hour day. A qualified representative from each of the following entities shall be present at the meeting:
   1. Owner
   2. Architect
   3. General Contractor
   4. Detention Equipment Contractor
   5. Security Control System Contractor
   6. Security Hollow Metal Manufacturer
   7. Security Glazing Manufacturer
   8. Security Hardware Manufacturer
   9. Architectural Hardware Subcontractor
   10. Electrical Contractor

B. Failure to follow submittal criteria will constitute submittals being non-compliant and will be reviewed as "Rejected/Resubmit". The DEC must submit the indicated and necessary shop drawing criteria for each individual specification section as an entire section and for each subsequent re-submittal.

C. Required submittal packages shall be submitted as a complete package for each Division 11 specification section. Failure to do so will result in the submittal being "Rejected" and returned.

D. Manufacturer's Data

1. Submit one (1) reproducible (digital format) copy of manufacturer's product specifications and installation instructions for each type of Detention Equipment.
2. Provide product data for shop primer and factory-applied finish(es).

E. Product Schedule: For detention equipment. Indicate types, quantities, sizes, and installation locations by room of each accessory required. Use same designations indicated on Drawings.

F. Shop Drawings

1. Submit one (1) reproducible (digital format) copy of all proposed and/or specified detention equipment.
2. Include plan and elevation layouts, construction details, embed plate locations and details, material descriptions, fastener and anchorage details, inserts, dimensions of individual components, and finishes.

G. Samples

1. Submit (upon the Owner's or Architect's request) one (1) each sample of any or all proposed and/or specified detention equipment items, to the Owner for his review and final approval. Coordinate with the Owner's representative as to whom and where these samples are to be delivered.

H. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for factory-applied color finishes for detention equipment and furniture.
   a. Color selections will be made according to Section 013300.

1.6 PRODUCT HANDLING

A. Protect units and finishes from damage during shipping, storage, handling, installation, and construction of other work in the same area.

B. Wrap, crate, and label each item for protection from damage. Deliver pertinent items to be built-in to the General Contractor or trades in accordance with the construction progress schedule to prevent any delay.

C. Keys shall be sent directly to the person and address as directed by the Owner, via direct mail with restricted delivery and return receipt requested.

1.7 GUARANTEE

A. Upon final completion, the Manufacturer/Installer shall provide a written warranty covering equipment against defective materials and workmanship, and guaranteeing satisfactory operation and performance for a period of one (1) year after Substantial Completion. The Manufacturer/Installer shall make necessary adjustments and replace any defective or broken parts caused by defective mechanical parts.

PART 2 - PRODUCTS

2.1 DETENTION EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:

1. Southern Folger Detention Equipment Co.; San Antonio, TX
2. Modern Detention Equipment; Cincinnati, OH
3. Willo Products Co.; Decatur, AL
4. JAILS Correctional Products; Minster, OH
5. Viking Products; Orange, CA
6. Bob Barker Company, Inc.; Fuquay-Varina, NC
7. Majestic Solutions, Inc.; Madison, AL
8. Trussbilt; Vadnais Heights, MN
9. Northwest Specialty Hardware, Inc. Clackamas, OR

B. Individual Detention Equipment Items:

1. **Detention Mirror, Single & Double:** with Embedded Back Plate
   a. Acceptable Manufacturer:
      1) SS No. 432/Southern Folger Detention Equip Co.
   b. Construction:
      1) Mirrors:
         a) Mirror frame shall be 11-1/4 inches by 17-1/4 inches, fabricated from 16 gauge cold finished steel, with 5/16 inch inner and outer flanges and having a tensile strength of not less than 53,000 pounds per square inch. Frame to have natural finish, chromium plated.
         b) Mirror opening shall be 10 inches by 14 inches, made of 0.031 inch sheet steel, polished to a high degree of reflectivity, and chromium plated.
         c) Include eight (8) chromium plated, security type, flat head machine screws, 1/4 inch diameter of proper length for use in backer plate.
      2) Embed Back Plates:
         a) Provide steel embed plates and 11 gauge anchor tabs as detailed and/or required by the mirror manufacturer (refer to details on Drawings).

2. **Detention Swing Stool, Wall-Mounted:**
   a. Acceptable Manufacturer
      1) Wall Mounted Stool / Willo
      2) No. BB518SS / Bob Barker Co. (modified)
      3) J-1-2528_25 / Jails Correctional Products (modified)
      4) Wall-mounted Stool (swing) / Trussbilt (modified)
   b. Construction:
      1) Stool seat shall be minimum 12 inches in diameter, with minimum 1-1/2 inch flange, fabricated of 16 gauge stainless steel, type 304 with No. 3 finish. Seat shall be attached to a minimum 1/4 inch thick steel seat reinforcement plate.
      2) Seat support shall be constructed of a 3/8 inch steel plate arm, welded to a 1 inch diameter steel swivel pin and to the seat reinforcement plate.
      3) Provide minimum 3/8 inch thick steel embed plate; seat swing arm shall be field welded to plate.
      4) Provide a non-removable hinge pin for locking the seat in place.
      5) The stool shall lock in the 90-degree position as well as in a position that allows for accessibility requirements.

3. **Detention Stainless Steel Floor-Mounted Bench:**
   a. Acceptable Manufacturer:
      1) (Custom fabricated)

b. Construction: Refer to details on Drawings.
   1) Seat shall be 11 gauge stainless steel, type 304 with No. 3 finish, with minimum 1-1/2 inch flanged edges.
   2) Bench supports shall be 2 inch Schedule 40 pipe, spaced no greater than 4'-0" on center, and welded to bench and base plate.
   3) All corners and joints shall be welded and ground smooth.
   4) Provide cuff rings where indicated.

4. **Hopper Pass:**
   a. Acceptable Manufacturer:
      1) Model PHE-1/Creative Industries Inc.; Indianapolis, IN.
      2) Hopper Pass / Safeguard Security Services, Inc.
   b. Construction:
      1) Size: 16 inches wide by 10-1/8 inches high by 7-3/4 inches deep
      2) Material: Stainless Steel
      3) Level I bullet-resistant.
      4) Hopper locks on staff side with a turn latch knob.

5. **Tilt-Drawer Pistol Locker: (6 - Compartment Surface Wall Mounted)**
   a. Acceptable Manufacturer: (6-compartment)
      1) No. 605-6 / Southern Folger Detention Equipment Co.
      2) No. 770-6 / Willo Products
      3) No. TDGL 6C / Bob Barker
      4) Tilt-Out Pistol Locker (6 compartment) / Viking Products
      5) MS-PL6TC / Majestic Solutions
   b. Construction:
      1) 3/16 inch shell and doors.
      2) Compartments lined with 1/8 inch felt (Verify with Owner the exact compartment size dimensions that are required to hold their jurisdiction's specific weapon type.)
      3) Compartment doors hung on continuous steel piano hinges.
      4) Provide each compartment with snap locks, each compartment individually keyed and master-keyed.
   c. Provide anchorage devices and security fasteners.
   d. Size/Mounting:
      1) Refer to details on Drawings for mounting.

6. **Recessed Toilet Paper Roll Holder:**
   a. Acceptable Manufacturer:
      1) SA11/ Bradley Corporation (modified)
      2) RTH-1/Willoughby Industries, Inc. (modified)
      3) 1840/Acorn Engineering Co. (modified)
   b. Construction (refer to details on Drawings):
      1) Recessed holder shall be 5 inches inside diameter and 4-1/2 inches deep made of 14 gauge Type 304 Stainless Steel.
      2) The face trim rim shall be beveled so as to fit flush with the wall surface and have an architectural satin finish.
      3) Four (4) anchor angles, 1 inch by 2-1/2 inches by 1/4 inch (1 inch wide) shall be welded to the exterior walls of the recessed enclosure with the 2-1/2 inch angle leg extended.

7. **Stainless Steel Counters and Work Shelves:**
   a. Acceptable Manufacturer:

1) (Custom fabricated)

b. Construction (Refer to details on Drawings):
1) Provide stainless steel shelf as detailed on Drawings.
2) Stainless steel shall be Type 304 with a No. 3 finish.
3) Provide anchorage devices and security head fasteners.
4) Field verify length prior to ordering

8. **Detention Grab Bars, Anti-Ligature:**
a. Construction (refer to details on Drawings)

9. **Wall Embed Plates for detention grab bars:**
a. Acceptable Manufacturer:
1) (Custom fabricated)
b. Construction (Refer to details on Drawings):
1) Embed Wall Plates shall be 1/2 inch thick Stainless Steel plates dimensioned as indicated on the drawings with embedment anchor tabs.
2) Grab Bars shall be bolted to embed plates as indicated on the Drawings.

10. All steel components shall be provided with one (1) shop coat of manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer selected for resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure, complying with performance requirements of FS TT-P-645.

2.2 DETENTION EQUIPMENT ACCESSORIES

A. Provide accessories, anchorage inserts and security fasteners for a complete tamperproof installation.

1. Exposed Security Fasteners:
a. Provide Torx-head (star with center reject pin) security fasteners for anchoring work in exposed security areas.
b. Finish shall match that specified of the item anchored.

B. Provide tools for fastening devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which Detention Equipment is to be installed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Proceed with installation only after unsatisfactory conditions have corrected.

3.2 INSTALLATION

A. Comply with manufacturer's printed installation instructions.

B. Touch-up painting of factory finish or factory primed items is the installer's responsibility.

C. Do not paint stainless steel embed plates.

D. Identify and coordinate the 'Filling of all Voids', by the General Contractor, between all materials of Detention Equipment, embeds and/or other physical construction items. Refer to specification Section 079200 – Joint Sealants and its article on "SECURITY SEALANTS" for types of sealants to be utilized.

E. All expenses incurred by the Architect in troubleshooting Detention Equipment Work, caused by inadequate workmanship or other form of non-performance on the part of the subcontractor, shall be borne by that subcontractor.

F. Coordinate installed equipment supplied to other contractors.

3.3 PROTECTION

A. Protect equipment and finishes until Substantial Completion.

B. Replace damaged equipment as directed by the Architect.

3.4 CLEANING

A. Clean grout, mortar, and other bonding material off detention equipment immediately after installation.

B. Touch-up Painting: Cleaning and touch-up painting of field welds, bolted connections and abraded areas of shop paint is specified in Division 9 Section "Painting".

C. Field finish painting of all equipment (not supplied with factory finish) in this section shall be done in accordance with Division 9 Section "Painting". All equipment shall be painted to match the color of its adjacent wall finish color, unless noted otherwise.

D. Clean equipment thoroughly prior to Substantial Completion.

END OF SECTION 111900

SECTION 111910- CUSTOM / SECURITY HOLLOW METAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUMMARY

A. Detention Equipment Contractor (DEC):
   1. Provide the Custom/Security hollow metal doors, door frames, window frames, and any other security hollow metal (SHM) (also referred to as Detention Hollow Metal (DHM)) components indicated on the contract document drawings, schedules, and specifications.
   2. Provide all necessary embed plates and/or anchors.
   3. Coordinate requirements for manual and electric hardware, monitoring and control devices, and SHM manufacturer-provided raceway/cabling junction boxes.
   4. Coordinate all electrical requirements, by the Electrical Contractor, with the Security Control Systems Contractor (SCSC) and electrical contractor.
   5. Schedule installation of this work to coincide with erection of the masonry work on the project so that these contractors can grout fill the custom/security hollow metal frames as their work is erected. The DEC is responsible for providing grout and grout holes for any frames that cannot be delivered and erected by the erection contractors.
      a. Construction Schedule: Provide a separate line for Custom/Security Hollow Metal doors and frames, which shall include adequate time for shop drawing preparation, submittal review, fabrication, and delivery of frames to the project site in time to meet above requirement and requirements of paragraph 3.2.B.2 in "Installation" article ahead. Coordinate with General Contractor.
   6. Provide on-site supervision of the delivery and installation of the custom/security hollow metal doors, frames, and windows.

B. General Contractor:
   1. Take delivery of the custom/security hollow metal doors, door frames, window frames, embedded plates/anchors, and store per manufacturer's recommendations.
   2. Install custom/security hollow metal doors, door frames and interior/exterior window frames, as indicated.
   3. Install all embedded plates and/or anchors, provided by the DEC.

C. Electrical Contractor:
   1. Coordinate electrical requirements with General Contractor and DEC.
   2. Coordinate this work with the control needs of the Security Control Systems Contractor (SCSC).

D. Provide Custom/Security hollow metal work manufactured by a single firm specializing in the production of this type of work.

E. When a fire resistance classification is indicated or scheduled for steel doors and frames, provide fire-rated doors investigated and tested as a fire door assembly, complete with type of hardware to be used. Identify each fire door with recognized testing laboratory labels, indicating applicable fire rating of steel doors.

F. Due to security concerns, no physical U.L. Fire Resistance Labels are to be attached to the door/frame assemblies. Instead, provide die-stamped identification numbers on fire-rated doors and frames and a letter of certification recording these numbers to the Owner/user for his record and files.

G. Fire-Rated Assemblies: Provide door and frame assemblies and window frame assemblies complying with the Virginia Construction Code and NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Test Pressure: Test according to 2018 IBC Section 716.2.1.
2. Smoke and Draft Control Assemblies: Fire door assemblies located in smoke barrier walls and smoke partitions shall also meet the requirements for a smoke and draft control door assembly tested in accordance with UL 1784. Installation of smoke doors shall be in accordance with NFPA 105.

H. When a fire resistance classification is indicated or scheduled for steel doors and/or frames containing components that have not been tested as an assembly, the manufacturer shall construct the door and frame components of the assembly in accord with the resistance rating, and certify in writing to the Owner, Enforcing Authority, Contractor, and the Architect that the door and frame components have been constructed in accord with the testing laboratory requirements in lieu of label.

I. Door and Panel Construction

1. Field Examination:
   a. The Custom/Security hollow metal contractor shall include in his bid the cost to provide one (1) replacement security hollow metal door that is to be selected for field testing.
   b. When directed by the Architect, the Contractor shall destroy a randomly-selected security hollow metal door or panel by sawing it in half.
   c. When examination discloses door construction at variance with the details specified, the door manufacturer shall replace all doors shipped to the project, as of the date of inspection, with doors constructed in conformance with project specifications.
   d. Under conditions of nonconformity, the door manufacturer shall pay for the destroyed door and related labor.
   e. When examination proves that the door was constructed in conformance with specifications, the Detention Equipment Contractor (DEC) shall immediately proceed to provide the replacements for the destroyed door.
2. All detention doors and panels for this Contract shall be constructed as specified and to meet the following ASTM Testing.
   a. The following tests (ASTM F 1450 – 12a, Grade 3) shall be conducted by an independent testing laboratory, upon doors with documentation attesting to compliance with the detention door construction required and indicated in this section.
   b. Doors for these tests shall utilize 14 gauge face sheets, 12 gauge frames, 3 feet by 7 feet (nominal size), not exceeding 225 lbs. in weight, and shall be fabricated as Door Type "DN" without a food pass (refer to Detention Door Types on Drawings).
      1) Test A – Door Static Load Test:
         a) Door shall be end supported and loaded at quarter points by a total load of 11,000 pounds for a period of one (1) minute. Door shall

deflect not more than 0.580 inch (14.73 mm) and shall rebound to within 0.100 inch (2.55 mm) of flatness after the loading is removed.

2) Test B – Door Rack Test:
   a) Door shall be secured at one short dimension and support at one other short dimension; unsupported corner shall be loaded for 30 seconds with a load of 5,500 pounds. Results should be as follows: Unsupported corner's measured deflection shall not exceed 3.55 inches (90.52 mm). Rebound to within 1.40 inches (35.7 mm) of flatness with no visual signs of weld failure.
3) Test C - Door Assembly Impact Test:
   a) 3'-0" x 7'-0" door, frame, and hardware assembly shall be constructed and rigidly mounted in the vertical position such that the door and locking hardware are operable. The door shall swing on 1-1/2 pair of full mortised butt hinges, and shall be locked using a Southern Steel No. 1070, 1080 or 10120 series lock or equal, with bolt size not to exceed 2 inch high x 3/4 inch wide, and latch throw not to exceed 7/8 inch.
   b) A door ram pendulum system, capable of delivering consistent impacts of up to 200 feet lb., shall be constructed such that impacts may be delivered to any area of the assembly. The pendulum ram system shall be positioned opposite the door side of the assembly such that the door swings away from the ram. While hanging at rest, the ram shall be positioned such that the striking nose just touches the target area of the door. The striking nose shall be made from C1010-1020 low carbon steel, the striking surface area of which shall not exceed 4.0 square inches +/- 0.04 square inches.
   c) With the door closed and locked and the above testing arrangement secured, the following series of impact tests shall be performed from the push side of the assembly:

Position and Order of Impacts	Number of Impacts	Impact Energy (ft. lbs.)
On door at center line of bolt, 6" from door edge	200	200
On door within 6" of bottom hinge	75	200
On door within 6" of center hinge	75	200
On door within 6" of top hinge	75	200
On the glass within 1.6" of the lower lock edge corner	100	200

   d) The door shall remain closed and locked throughout the testing procedure, and the assembly shall not be damaged such that forcible egress can be obtained. After testing is completed, the door shall be capable of being unlocked and operated such that normal egress can be obtained.
4) Test D - Door Edge Crush Test:
   a) Door shall be placed in test fixture, hinge side up. Apply pressure perpendicular to door edge until required loads are reached. Remove the door from the framework and place the door back into the test fixture, with the lock side up, and then repeat the test procedure.

Required results: Both the hinge and lock edge shall support a load of at least 8,000 lbf with a deflection of less than 0.25 inch (6mm).

3. References:
   a. American Society of Testing and Materials (ASTM Standards F1450 and F1592)
   b. National Association of Architectural Metal Manufacturers (NAAMM)
   c. Hollow Metal Manufacturers Association (HMMA Standard 863)
   d. Underwriters Laboratories (UL)

1.3 ACTION SUBMITTALS

A. Required submittal for Custom/Security Hollow Metal Work shall be submitted as a complete package. Failure to do so will result in the submittal being "Rejected" and returned.

B. Manufacturer's Data
   1. Submit one (1) reproducible (digital format) copy of manufacturer's product specifications and installation instructions.

C. Shop Drawings:
   1. Submit one (1) reproducible (digital format) copy of all proposed and/or specified custom security/detention hollow metal work, and elevation layouts.
   2. Include dimensional construction details of each frame type, elevations of door and frame design types, conditions at openings, fastener, anchorage, and reinforcement details. Provide details of lock pockets and factory fabricated accessories, including, but not limited to, food passes and lockable paper passes, location & installation requirements of finish hardware & reinforcements, and details of joints and connections. Provide details of doors, including vertical and horizontal edge details, and metal thicknesses.
   3. Drawings shall use the same plan and elevation numbers as indicated on the contract document drawings.

D. Certificates:
   1. Manufacturer shall submit a certificate, individually dated and signed by hollow metal manufacturer, certifying that all materials meet specification requirements.
   2. Welder certificates signed by Contractor certifying that welders comply with requirements (Section 4 of ANSI/AWS D1.3) specified under "Quality Assurance" article.

E. Owner's Tools
   1. Furnish five (5) security fastener tools for each different type of security fastener, being utilized, at the time of Substantial Completion.

1.4 JOB CONDITIONS

A. Hardware Coordination Conference: Refer to Finish Hardware and Security Hardware Specification Sections.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle hollow metal work per manufacturer's requirements.

1.6 GUARANTEE

A. Upon Final Completion, the Manufacturer/Installer shall provide a written warranty covering the custom / security hollow metal work against defective materials and workmanship and guaranteeing satisfactory operation and performance for a period of one (1) year after Final Completion. The Manufacturer/Installer shall make necessary adjustments and replace any defective or broken parts caused by defective mechanical parts.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS OF CUSTOM/SECURITY HOLLOW METAL:

A. Manufacturers should submit evidence of successful detention facility experience within the last five years, and a list of projects of scope comparable to or larger than this project completed within the last five years, with Owner, Architect, and General Contractor contact names and telephone numbers.

1. Claborn Manufacturing Co.; Hartselle, AL
2. Trussbilt (Trussbilt/American); Vadnais Heights, MN
3. American Steel Products (Trussbilt/American); Swainsboro, GA
4. Titan Steel Door, LLC; Gainesville, GA

2.2 MATERIALS

A. FERROUS METALS

1. Metal Surfaces, General: For hollow metal work exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
2. Steel Plates, Shapes, and Bars: ASTM A 36.
3. Uncoated Structural Steel Sheet:
   a. Provide sheet steel types (manufacturing method), quality, and grade, as follows:
      1) Cold-Rolled Structural Steel Sheet: ASTM A1008/ A1008M, or as noted or required for loading.
      2) Hot-Rolled Structural Steel Sheet: ASTM A1011/ A1011M, unless otherwise noted or required for design loading rolled.
4. Uncoated Steel Sheet: Commercial quality, cold-rolled steel sheet, ASTM A 366.
5. Hot-Rolled Steel Sheet: ASTM A 1011.
6. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, CS (Commercial Steel), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
7. Gray Iron Castings: ASTM A 48, Class 30.
8. Malleable Iron Castings: ASTM A 47, grade 32510.
9. Brackets, Flanges and Anchors: Metal to match material and finish of supported rails, or as noted.
10. Concrete Inserts: Threaded or wedge type; galvanized ASTM A 47 malleable iron or ASTM A 27 cast steel castings. Provide ASTM A 153 hot-dip galvanized bolts, washers, and shims as required.

11. Welding Rods and Bare Electrodes: Select as per AWS specifications for the metal alloy to be welded.
12. Fasteners: General: Provide Torx–head (star design with center reject pin) security fasteners for anchoring work in exposed security areas. Provide one hundred (100) additional security glazing stop fasteners.
13. Shop Primer for Ferrous Metal (alkyd based): Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645. If the Shop Primer described above is provided instead of the Phenolic-Phosphate based water primer described in item No. 13 below, then all interior surfaces of the hollow metal frame assembly's jambs, heads and sills are to receive a coating of water based coating of Aqueous Automotive Corrosion Control Coating Terotex No. 895213 by Henkel Surface Technologies (or equal).
14. Shop Primer for Ferrous Metal: Interior doors and frames shall be thoroughly cleaned, degreased, bonderized, and provided with one coat of North American Technologies No. 40-P-1802 (or equal) primer.
    a. PRIMER Specifications:
        1) Phenolic Water Based Primer
        2) Product Number: 40-P-1802
        3) Description: Phenolic phosphate based water primer designed for use in extremely corrosive building applications.
        4) Application: Apply by brush, roller, spray, or dip.
        5) Percent solids per weight: 50 percent +/- 2
        6) Weight/Gallon; 8.93
        7) PVC: 39 percent
        8) Gloss 60 degree: 0 degree
        9) Salt Spray: 200 hours @ 1.5m
        10) Recommended Film Thickness: 0.8 – 1.5m
        11) Color: Gray or Beige
        12) Rust Inhibitive Pigment: Zinc Phosphate
        13) Application Use: Primer shall be used over properly cleaned, rust free steel for proper rust inhibition. Steel should be stored in a dry environment, protected from damage to surface. Steel must be top coated within one (1) month of arrival with any commercially available top coat, water based or solvent based.

2.3 FABRICATION

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Shear and punch metals cleanly and accurately. Remove burrs.

D. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Remove sharp or rough areas on exposed traffic surfaces.

F. Weld corners and seams continuously to comply with AWS recommendations and 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 that no roughness shows after finishing, and contour of welded surface matches those adjacent.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Torx-head flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

H. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

I. Shop Assembly:

1. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation. Cut, reinforce, drill, and tap fabricated work as indicated to receive finish hardware, screws, and similar items.
2. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles as indicated on drawings.
3. After fabrication, interior and exterior doors and frames shall be thoroughly cleaned, degreased, bonderized, and provided with one coat of shop primer.
4. Fabricate exterior doors, panels, and frames from galvanized sheet steel.
5. Clean, treat, and paint exposed, galvanized surfaces of fabricated hollow metal units.

J. Finish Hardware and Security Items Preparation:

1. Templates for all hardware attachments and security items shall be provided by the hardware suppliers to the Detention Equipment Contractor (DEC) for transmittal to the frame and door manufacturer.
2. Fabricate frames with mitered corners, welded continuously and ground smooth. Frames and doors shall be mortised, reinforced, machined, and prepared for all hardware.

2.4 HOLLOW METAL DOORS

A. Provide hollow metal doors of the types and styles indicated on the drawings and schedules. Furnish detailed accessory items such as food pass.

B. All hollow metal doors shall have a flush closed top edge and bottom edge.

C. Size/Thickness/Type: Refer to Detention Door Schedule and Detention Door Types.

D. Gauge: 14 gauge face sheets.

E. Coordinate electric hardware requirements to be integrally built into the door with the hardware requirements.

F. Internal Core Construction: Provide one of the following two (2) types:
   1. Steel-Stiffened Core: Steel stiffened by continuous vertically formed steel hat sections, which upon assembly, shall span the full thickness of the interior space between door faces. Stiffeners shall be 16 gauge (minimum) to meet the performance standards established in the quality control section of this specification, spaced such that the vertical interior webs shall be no more than 4 inches o.c. and securely fastened to both face sheets and together by spot welds spaced a minimum of 2-1/2 inches o.c. vertically. Spaces between stiffeners shall be filled with 3 lbs./cu. ft. fiberglass or mineral Rockwool batt–type material.
   2. Truss-Stiffened Core: Continuous, inner–reinforcement full height and width shall be true truss design with triangular form, the shape of which cannot be altered without changing the length of the sides. Flat apexes shall be resistance spot welded on 2-3/4 inch centers horizontally and 3 inch centers vertically. Each flute of reinforcement to be fire and sound insulated with 6 lbs./cu. ft. Rockwool batt-type material.

G. Top and Bottom Channels: The top and bottom edges shall be closed with a continuous channel, not less than 12 gauge, welded to both face sheets at a minimum of 4 inches o.c. Reinforce the top closing end channel with an additional 12 gauge flush closing channel full width continuously welded to the vertical edge of the door at all four corners and at the center.

H. Vertical Edges:
   1. All vertical edges shall be reinforced by a continuous steel channel, not less than 12 gauge, extending the full length of the door. Continuously weld and finish smooth edge seams without visible joints or seams on exposed faces or stile edges.
      a. For single-acting swinging detention doors, lock and hinge edges shall be beveled 1/8 inch in 2 inches.

I. Exterior Doors:
   1. Fabricate exterior doors of two outer, galvanized, stretcher-leveled, steel sheets. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts. Provide weep hole openings in the bottom of exterior doors to permit the escape of entrapped moisture.

J. Interior Doors.
   1. Fabricate interior doors of two outer, cold-rolled, stretcher-leveled, steel sheets. Construct doors with smooth, flush surfaces, without visible joints or seams on exposed faces or stile edges.

K. Finish Hardware Reinforcement:
   1. Hinges: Steel plate 3/16 inch thick by full height, secured by spot–welds 4 inches o.c.
   2. Mortise Locksets and Dead Bolts: 3/16 inch thick steel sheet, welded to inside of door on detention side (cell side) and 3/16 inch thick steel lock mounting plate, beveled at edges, applied to the surface of the door with security screws.
   3. Cylinder Locks: 12 gauge steel sheet, secured with not less than 2 spot–welds.
   4. Flush Bolts: 12 gauge steel sheet, secured with not less than 2 spot–welds.
   5. Surface–Applied Closers: 12 gauge steel sheet, secured with not less than 6 spot–welds.
   6. Push Plates and Bars: 16 gauge steel sheet (except when through bolts are indicated or specified), secured with not less than 2 spot–welds.

7. Automatic Door Bottoms: Reinforce for mortise–type units with 12 gauge steel, and 16 gauge for surface–applied units.
8. Vision Panels: 12 gauge steel sheet around perimeter, welded 3 inches o.c. field installed.

L. Removable glass stops shall consist of 10 gauge "Z"-type stops securely fastened to the door using Torx-head (star with center reject pin) security screws of the size, strength and spacing necessary to satisfy impact performance criteria.

2.5 HOLLOW METAL FRAMES

A. Provide custom/security hollow metal door frames of the types and styles indicated on the drawings or schedules, interior and exterior. Conceal all anchorage, unless noted otherwise.

B. Provide custom/security hollow metal frames for windows, transoms, side lites, borrowed lites, and other openings as indicated on the drawings, interior and exterior. Conceal all anchorage, unless noted otherwise.

C. Provide galvanized frames at exterior locations and as indicated in the Detention Door Schedule.

D. Fabricate frames with mitered corners continuously welded through head inside corner and miter ground smooth.

E. All frames shall be provided with approved jamb anchors (4 per jamb minimum), floor knees, plaster boxes (26 gauge steel minimum), removable angle spreaders, and door silencers (3 Glynn Johnson GJ64 silencers minimum per door) by the manufacturer. Continuous floor anchors below glazing shall be 12 gauge minimum with holes for fasteners at 12 inches on center.

F. Types: Refer to Detention Door Schedule and Detention Frame Elevations.

G. Gauge: 12 gauge.

H. Finish Hardware Reinforcement: Reinforce frames for required finish hardware, as follows:
1. Hinges and Pivots: Hinge Reinforcing Steel plate 3/16 inch thick by 2 inches wide by 10 inches long welded to the inside of the frame and a Back-Up Angle 3/16 inch thick welded to the Hinge Reinforcement steel plate and to the frame at both its ends. Back-Up Angle shall be drilled and tapped to accommodate security screws to fasten the security hinges.
2. Strike Plate Clips: Steel plate 3/16 inch thick by 1-1/2 inches wide by 3 inches long.
3. Surface–Applied Closers: 12 gauge steel sheet, secured with not less than 6 spot–welds.
4. Provide lock pockets as indicated and required.

I. Removable glass stops shall consist of 10 gauge angles securely fastened to the frame using Torx–head (star with center reject pin) security screws of the size, strength and spacing necessary to satisfy impact performance criteria. During shipment of these assemblies, non–security fasteners may be substituted to hold glass stops in place. The security fasteners shall be included in the same shipment but packaged separately for protection until used to stop in the required glazing.

J. Provide grout openings for all vertical or horizontal hollow metal frame sections that are not accessible for grouting due to steel lintels or other obstructions.

K. Provide separate conduit systems for door control, intercom, etc., within hollow metal frames.

2.6 ELECTRICAL REQUIREMENTS

A. Custom/security hollow metal fabricator shall furnish and install junction boxes and conduit between junction boxes in door frames for electric locks, door position switches, emergency release buttons, and intercom call stations; coordinate special hardware requirements with the Electrical Contractor and Security Hardware Subcontractor.

B. Refer to the Detention Door Schedule(s), Security Hardware Specification Section, and Details.

2.7 SECURITY/DETENTION EQUIPMENT ACCESSORIES

A. Provide accessories, anchorage inserts, and security fasteners for a complete, tamperproof installation.

B. Exposed Security Fasteners:

1. Provide Torx–head (star design with center reject pin) security fasteners for anchoring work in exposed security areas. Provide one hundred (100) additional security glazing stop fasteners.
2. Finish shall match that specified of the item anchored.
3. Provide three (3) sets of tools for each type of security fastener used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which steel doors and frames are to be installed. Notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. Install hollow metal units and accessories in accordance with final shop drawings and manufacturer's data, and as herein specified.

B. Placing Frames:

1. Comply with the provisions of S.D.I. 105.
2. Place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed and aligned (using metal shims), and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
3. Identify and coordinate with the work of Section 079200 – Joint Sealants to assure the 'Filling of all Voids' around the perimeter of custom/security hollow metal frames. Refer to specification Section 079200 – Joint Sealants and its article on Security Sealants for types of sealants to be utilized.
4. Install fire-rated frames in accordance with NFPA 80.
5. Grout fill solid all custom/security hollow metal frame jambs, sill, and head sections. Provide grout openings in hollow metal frames where access for grout filling of frame sections may be restricted due to steel lintels or other obstructions. Prior to filling jamb, head, and sill frame sections with grout, verify that the required Phenolic Water Based Primer has properly coated all interior surfaces. If the primer coating is omitted or damaged, field apply a coating of the Phenolic Water Based Primer.

6. If the supplied Shop Primer is a universal modified alkyd primer, instead of the Phenolic-Phosphate based water primer, below, then all interior surfaces of the hollow metal frame assembly's jambs, heads, and sills are to receive a coating of water-based coating of Aqueous Automotive Corrosion Control Coating Terotex No. 895213 by Henkel Surface Technologies (or equal).
7. Prior to filling intermediate frame sections with grout, verify that the required Phenolic Water Based Primer has properly coated all interior surfaces. If the primer coating is omitted or damaged, field apply a coating of the Phenolic Water Based Primer.

   NOTE: If the supplied Shop Primer is a universal modified alkyd primer, instead of the Phenolic-Phosphate based water primer, below, then all interior surfaces of the hollow metal frame assembly's jambs, heads and sills are to receive a coating of water based coating of Aqueous Automotive Corrosion Control Coating Terotex No.895213 by Henkel Surface Technologies (or equal).
8. In masonry construction, locate four (4) wall anchors per jamb at hinge and strike levels. Setting of anchors and grout filling of frame jambs is specified in Division 4 Sections "Unit Masonry" and "Reinforced Unit Masonry" as applicable.

C. Door Installation:
1. Fit custom/security hollow metal doors accurately in their respective frames with the following clearance tolerances or as indicated on the Detention Door Schedule (utilize clearances specified in S.D.I. 100 for applications not listed below):
   a. Jambs and Head: 1/8 inch +/- 1/16"
   b. Meeting Edges, Pair of Doors: 1/8 inch 1/8 inch +/- 1/16"
   c. Bottom: 3/8 inch (when no carpet or threshold)
   d. Bottom: 1/8 inch (when having carpet or threshold)
2. Install fire-rated doors per NFPA 80 (or per local applicable codes, if more stringent).

D. All expenses incurred by the Architect in troubleshooting the Custom / Security Hollow Metal Work, caused by inadequate workmanship or other form of non-performance on the part of the subcontractor, shall be borne by that subcontractor.

3.3 ADJUST AND CLEAN

A. Final Adjustments:
1. Check and readjust operating finish hardware items in hollow metal work immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including detention doors or frames which are warped, bowed, or damaged or otherwise unacceptable.

B. Clean grout and other bonding material off detention doors and frames immediately after installation.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M

D. Prime Coat Touchup:
1. Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
2. After finishing smooth field welds, apply air-drying primer.

END OF SECTION 111910

SECTION 111950 - SECURITY GLASS AND GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUMMARY

A. Detention Equipment Contractor (DEC):
   1. Provide security glass and glazing work as indicated.
   2. Applications of security glass and glazing include the following:
      a. Security glazing of interior and exterior doors.
      b. Security glazing of interior and exterior hollow metal frames and miscellaneous interior security glazed frames.
      c. Security glazing at Security Desk in Lobby.

B. General Contractor:
   1. Coordinate efforts of security glazing with other glazing work and the installation of security hollow metal work.

1.3 GLAZING CRITERIA PERFORMANCE REQUIREMENTS

A. Security Glass:
   1. Comply with multiple impact and high energy impact tests:
      a. UL 972
      b. ASTM F 1233.
      c. ASTM F 1915.

B. Bullet Resistant Glass:
   1. Comply with UL 752. Provide glazing, listed and labeled by UL for the required rating.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated:
   1. Design Wind Pressures: As indicated on Drawings.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with Safety Standard for Architectural Glazing Materials; 16 CFR Part 1201, Category II.

E. Security Polycarbonate:
   1. Comply with ASTM F 1233 containment test body passage or contraband passage level as described in Security Glazing "Compositions" section.
   2. Comply with ASTM F 1915 containment test using pendulum impact having blunt, sharp and axe heads with heat /fire (torch) applied.
   3. Bullet resistant products shall be tested and listed by UL 752 or ASTM F 1233, whichever is applicable and certified to by the manufacturer of the security glazing.
   4. Maintenance serviceability test, all types:
      a. Products will not exhibit abrasion haze of more than 15 percent when tested to ANSI Z26.1. Taber Abrader test No. 17 for 100 cycles having a 500 gram load.

b. No extraordinary procedures shall be required for window cleaning. Manufacturer's recommendations shall be followed.

F. Experience Criteria:
1. Minimum of five (5) years' experience manufacturing specified item.
2. Minimum of five (5) years successful installations on detention and correctional facilities.
3. Security glazing manufacturer approval:
a. No security glazing manufacturers will be approved after the bid date. All manufacturers must submit qualifications to the Architect for consideration no less than fifteen (15) days prior to bid date.

1.4 ACTION SUBMITTALS:

A. Required submittals for this section shall be submitted as one complete package. This shall include, but not be limited to, manufacturer's data, shop drawings, and samples. Failure to do so will result in the submittal being "Rejected" and returned.

B. Manufacturer's Data – Glass and Glazing:
1. Submit one (1) reproducible (digital format) copy of manufacturer's specifications and installation instructions for each type of glass, setting blocks, sealants, and gaskets required.
2. Include test data substantiating that glass complies with specified requirements.
3. Indicate by copy of transmittal that Glazier has received copy of handling and glazing instructions.

C. Manufacturer's Data - Glazing Materials:
1. Submit one (1) reproducible (digital format) copy of manufacturer's specifications and installation instructions for each type of glazing, sealant, tape, compound, gasket and associated miscellaneous material required. Include manufacturer's published data, letter of certification, or certified test laboratory report indicating that each material complies with the requirements as is intended generally for the applications indicated.
2. Indicate by copy of transmittal that Glazier has received copy of each glazing component's recommended installation instructions.

D. Shop Drawings:
1. Submit FULL SCALE hollow metal sill glazing installation detail drawings. Details shall indicate the actual glazing products being supplied (i.e. setting blocks, sealants, gaskets), their actual sizes, their placements/spacing and their dimensional relationships within the assembly.
a. Provide details for fire-rated and non-fire-rated security glazing.
b. Provide details for exterior security glazing.

E. Security Glazing Schedule: List glazing types for each opening and location. Use same designations indicated on Drawings.

F. Shading Film product data and samples: Submit one (1) reproducible (digital format) copy of manufacturer's data and two (2) sets of samples of interior-applied, shading "Films" being considered for glazing types indicated to receive it (refer to Security Glazing types).

G. Sample Warranties: For security glazing.

1.5 JOB CONDITIONS

A. Weather Conditions:

1. Do not proceed with installation of liquid sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for sealant installation.

1.6 WARRANTY

A. Security Glass:

1. Provide Owner a five (5) year guarantee for materials and labor from date of Substantial Completion for all security glazing.
2. Guarantee shall include delamination.
3. The guarantee shall be by the manufacturer, co-signed by the Installer and Detention Equipment Contractor.
4. Manufacturer's warranty on laminated polycarbonate:
   c. Provide written warranty by the manufacturer of mar-resistant laminated polycarbonate agreeing to supply replacement product, FOB point of manufacture, freight allowed to project site, in the event of material failure due to manufacturing defect. Defect shall be defined as edge separation, delamination, breakage or coating failure. Time period for said warranty shall be a minimum of five (5) years.

PART 2 - PRODUCTS

2.1 GLAZING TESTING CRITERIA

A. Security Glazings:

1. Comply with ANSI standard Z–97.1–2009 Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test.
2. Comply with and pass UL multiple impact test.
3. Comply with and pass UL high energy impact test.
4. Comply with ASTM F1915 Standard Test Methods for Glazing for Detention Facilities.

B. Security Polycarbonates:

1. Types: Laminated or monolithic polycarbonate sheet shall be extruded sheet, UV stabilized, but when laminated uses a interlayer of 0.030 inch "LR" resin. Material layups will vary according to manufacturer's requirements to meet constructions listed in Security Glazing Compositions section. Polycarbonate laminates shall have a flexural strength not less than 13,500 psi (ASTM D790, 180 degrees F continuous service temperature). Products must conform to the International Building Code (IBC) as an approved light transmitting plastic with a CC-1 flammability performance rating.

C. APPROVED MANUFACTURERS: (SUBJECT TO COMPLIANCE WITH PERFORMANCE)

1. Global Security Glazing; Selma, AL
2. DLUBAK Corp; Blairsville, PA
3. LTI Group; Pittsfield, MA
4. McGrory Glass; Paulsboro, NJ

2.2 SECURITY GLAZING COMPOSITIONS

A. **Polycarbonate Sheet Glazing:**

1. **Type SG-1P** – 3/4 inch nominal, multi-ply clear polycarbonate, ASTM F1915 Grade 1, 60 minute containment rated; Global Security Glazing RC 750 or approved equal.
2. **Type SG-2P** – 1/2 inch nominal, multi-ply clear polycarbonate, ASTM F1915 Grade 2, 40 minute containment rated; Global Security Glazing MPC 500 or approved equal.
3. **Type SG-3P** - 3/8 inch nominal, multi-ply clear polycarbonate, ASTM F1915 Grade 3, 20 minute containment rated; Global Security Glazing MPC 375 or approved equal.

B. **Glass Clad Polycarbonates:**

1. **Type SG-10** – 1 inch nominal, 1/8 inch heat strengthened glass, 1/4 inch clear polycarbonate, 3/8 inch clear polycarbonate, 1/8 inch heat strengthened glass, Apply the shading "Film" on the glazing surface away from the inmate occupancy and after the building has received its Certificate of Occupancy. The shading "film" color is to be selected by the Owner under the supervision of the Architect. ASTM F1915 Grade 1, 60 minute containment rated; Global Security Glazing SP028 or approved equal.
2. **Type SG-11** – (NOT USED)
3. **Type SG-12** – (NOT USED)
4. **Type SG-13F** – (NOT USED)
5. **Type SG-14F** - 1-1/8 inch nominal, 1/4 inch wire glass, 1/8 inch clear polycarbonate, 3/8 inch clear polycarbonate, 1/8 inch clear polycarbonate, 1/4 inch wire glass. 45 minute fire rated, ASTM F1915 Grade 1; Global Security Glazing – ICGCP 2416WW.
6. **Type SG-15F** – (NOT USED)
7. **Type SG-16F** - (NOT USED)
8. **Type SG-17F** – (NOT USED)
9. **Type SG-18F** – (NOT USED)
10. **Type SG-19F** - (NOT USED)
11. **Type SG-20** – 1-1/8" nominal, UL 752 Level 3 Bullet Resistant Glazing; Global Security Glazing – SP311.
12. Wire Glass for Glass-Clad Polycarbonates: Provide square mesh pattern.

C. **"Shading Film" Manufacturers:**

1. Madico Window Films Madico, Inc.; St. Petersburg, FL (727) 327-2544 or (888) 887-2022
2. Aegis Films, Inc.; Norcross, GA (770) 417-1281
3. LLumar Solar Control Window Film; Bassett, VA (276) 629-1711

4. MaxPro Window Films; Whiteville, NC (877) 573-3456
5. Sun Block, Inc.; Midlothian, VA (804) 379-4123
6. X-RAYZ Window Tinting; Charlottesville, VA (434) 296-0176
7. Vista Window Film/CP Films, Inc.; Martinsville, VA (888) 273-4567
8. Film Technologies International, Inc.; St. Petersburg, FL (727) 327-2544

2.3 GLAZING SEALANTS/COMPOUNDS

A. Basic Requirements:
1. Provide black exposed glazing materials, unless another color is indicated, or unless another color is selected by Architect from manufacturer's standard colors.
2. Provide hardness of materials as recommended by the manufacturer for the required application and condition of installation in each case.
3. Provide only compounds known (proven) to be fully compatible with surfaces contacted.
4. Provide sealants recommended by manufacturer of glazing type specified.
5. Provide silicone sealant bead along entire glazing perimeter, between glazing and stops (removable and non-removable), installed with a substantial "wash" away from security glazing, providing a watertight seal from detergents and cleaning solutions.

B. Silicone Rubber Glazing Sealant:
1. Silicon rubber, one part elastomeric sealant, complying with FS TTS001543, Class A. Provide acid–type for porous channel surfaces, and provide non–acid type for porous channel surfaces (where any of the channel surfaces are porous).

C. Butyl Rubber Glazing Tape:
1. Partly vulcanized, self–adhesive, non-staining, elastomeric butyl rubber tape, 98 percent solids, intended for 35 percent compression, non-appreciable deterioration for 3000 hour test in Atlas Weatherometer.

D. One Component Urethane Glazing Sealant:
1. Solvent based, one component polyurethane; compounded specifically for glazing; complying with FS TT200230, Class A, Type 11.

E. Acrylic Latex Glazing Compound:
1. Modified latex rubber and acrylic emulsion polymer, compounded specifically as a glazing sealant with permanent flexibility (non–hardening), non–staining, and non–bleeding.

F. Butyl Rubber Glazing Sealant:
1. Polymerized butyl rubber compound with inert fillers and pigments, solvent based with 75 percent solids, non–sag, tack–free within twenty-four (24) hours, paintable, non–staining.

G. Preformed Butyl rubber Glazing Sealant:
1. Tape or ribbon (coiled on release paper) of polymerized butyl, or mixture of butyl and polyisobutylene, compounded with inert fillers and pigments, solvent based with minimum of 95 percent solids, with thread or fabric reinforcement, tack–free within twenty-four (24) hours, paintable, non–staining.
2. Provide combination type and encased continuous rubber shim, of approximately 50 durometer hardness.

2.4 GLAZING GASKETS

A. Provide glazing gaskets as recommended by manufacturer.

B. Structural Rubber Glazing Gaskets:
   1. Neoprene extrusions with injection molded corner units, fabricated into frames, with either integral or separate locking strips (zippers); comply with ASTM C542, black.

C. Molded Neoprene Glazing Gaskets:
   1. Molded or extruded neoprene gaskets of the profile and hardness required for watertight construction; comply with ASTM D 2000 designation 2BC 415 to 3BC 620, black.

D. Polyvinyl Chloride Glazing Gaskets:
   1. Extruded, flexible PVC gaskets of the profile and hardness shown, or as required for watertight construction; comply with ASTM D 2287.

E. Vinyl Foam Glazing Tape:
   1. Closed cell, flexible, self-adhesive, non–extruding, polyvinyl chloride foam tape; recommended by manufacturer for installation of glass, with only nominal pressure in the glazing channel; comply with ASTM D 1667.

F. Glazing Sealants - Materials specifically for polycarbonates:
   1. General
      a. Provide products and materials of the type indicated and approved for use with the specified security glass polycarbonate products.
      b. Comply with recommendations of the manufacturers of each type of glazing material for the storage, installation, and finishing of respective products.
   2. Compatibility
      a. Install using sealants of proven compatibility with the various surfaces in which they will come in contact with, including all submitted silicones, setting blocks, glazing tape, and edge block materials.
      b. Provide sealants of the color specified, or from manufacturer's standard as chosen by the Architect.
   3. Materials
      a. Silicone sealants shall be single component elastomeric silicone complying with the following:
         1) FS TT-S-001543A (COM-NBS), Class A, non-sag.
         2) ASTM C 920, Type S, Grade NS, Class 50, Use G for high modulus silicone.
         3) DOWSIL 995 Silicone Structural Sealant or equal.
      b. Glazing tape shall be pre-formed polyisobutylene butyl sealant, Tremco 440, Tremco Polyshim II, or equal.
      c. Setting blocks shall be neoprene or EPDM (70 to 90 durometer) 3 inches to 4 inches long.
      d. Edge blocks shall be neoprene, EPDM or silicone (40-50 durometers) and of a size and spaced as to prevent lateral movement.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. Setting Blocks:
   1. Neoprene, 7090 durometer hardness, proven compatible with sealants used.

B. Spacers:
   1. Neoprene 4050 durometer hardness, with proven compatibility with sealants used.

C. Compressible Backer Rod:
   1. Closed cell or waterproof jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 510 psi compression strength for 25 percent deflection.

D. Self–adhesive, Compressible Filler:
   1. Closed cell, polyvinyl chloride foam compressible filler, size 1/2 inch thick by full depth of intermediate composite tube section; color–black. Provide with pressure sensitive adhesive on one side for attachment to tube section. Compressible filler as manufactured by Tremco.

E. Cleaners, Primers, and Sealers:
   1. Type recommended by sealant or gasket manufacturer.

F. Exposed Security Fasteners:
   1. Provide Torx–head (star design with center pin) security fasteners for anchoring work in exposed security areas.
   2. Finish shall match that specified of the item anchored. (Do not paint Torx- heads.)
   3. Provide three (3) sets of tools for security fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing and glazing channel surfaces, backing, removable stop design, and the conditions under which the glazing is to be performed. Notify the Architect in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the glazing until unsatisfactory conditions have been corrected.

3.2 STANDARDS AND PERFORMANCE

A. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.

B. Protect glass from edge damage during handling, installation and operations of the building.

C. Glazing channel dimensions are intended to provide for necessary minimum bite on the glass, minimum edge clearance and adequate sealant thicknesses, with reasonable tolerances. The Glazier is responsible for correct size for each opening, with the tolerance and necessary dimensions established.

D. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturer's technical representatives direct otherwise.

E. Comply with "Glazing Manual" by Flat Glass Marketing Association except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.

F. Inspect each piece of glass immediately before installation and eliminate any which have observable edge damage or face imperfections.

G. Unify appearance of each series of lites by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.

H. Cut and install colored (tinted) glass as recommended in "Technical Services Report No. 104" by PPG Industries.

I. All expenses incurred by the Architect in troubleshooting the Security Glass and Glazing work, caused by inadequate workmanship or other form of non-performance on the part of the subcontractor, shall be borne by that subcontractor.

3.3 PREPARATION FOR GLAZING

A. Clean glazing channels and other framing members to receive security glazing, immediately before glazing. Remove coatings not firmly bonded to substrates. Remove lacquer from metal surfaces wherever elastomeric sealants are used.

B. Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer.

3.4 GLAZING

A. Comply with glass, window, and frame manufacturer's recommendations.

B. Install setting blocks, of proper size, at quarter points of sill rabbet. Set blocks in thin course of the heelbead compound, if any.

C. Glazing shall be set with equal bearing for entire width.

D. Provide spacers inside and out, and of proper size and spacing, for all glass sizes larger than 50 inches, except where gaskets are used for glazing. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

E. Voids and Filler Rods:
   1. Prevent exudation of sealant or compound by forming voids or installing filler rods in the channel at the heel of jambs and head (do not leave voids in the sill channels) except as otherwise indicated, depending on lite size, thickness, and type of glass, and complying with manufacturer's recommendations.

F. Do not attempt to cut, seam, nip or abrade glazing which is tempered, heat strengthened, or coated.

G. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

H. Provide silicone sealant bead along entire glazing perimeter, between glazing and stops (removable and non-removable), installed with a substantial "wash" away from the glass, providing a watertight seal from detergents and cleaning solutions.

I. Clean and trim excess glazing materials from the glass and stops or frames promptly after installation, and eliminate stains and discolorations.

J. Specific recommendations for polycarbonate glazing installation:
   1. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6 inches from corner unless otherwise required. Set blocks in thin course of sealant.
   2. Provide spaces inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 inches, except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed tape thickness.
   3. Setting blocks, edge blocks, silicone cap beads, glazing tapes/filler rod installation shall comply with GANA (Glass Association of North America) 2008 Edition standards.
   4. Tapes and gaskets are to be installed slightly protruded so as to eliminate dirt and moisture pockets. Exposed sealants shall form a wash away from the glazing.
   5. Polycarbonate glazing edge engagements shall generally be 1 inch, unless otherwise approved by the Architect and confirmed by the manufacturer.
   6. Expansion allowances for polycarbonate shall generally be 1/16 inch per 12 inches, per 100 degrees F changes in temperature or as approved by the Architect per manufacturer's recommendations.
   7. Polycarbonate installation and fabrication shall comply with the written recommendations of the polycarbonate manufacturer. Copies of aforementioned recommendations shall be furnished to the Architect.
   8. Install all polycarbonates as late as possible in the construction of the facility. Masking should be removed approximately 1 to 2 inches from the edges so as to allow the glazing tape/silicone to come in contact with the polycarbonate.
   9. All polycarbonate lites, exposed to direct sunlight, shall have the masking entirely removed and then securely covered with polyethylene taped to the frames. Failure to remove the masking at this time may result in adhesion of the masking, preventing later removal.
   10. Where wedge shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesive, including embedment of gasket tail in cured heel bead.
   11. Glaze units at the building site.

K. Gasket Glazing:
   1. Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in the glazing system.

3.5 CURE, PROTECTION AND CLEANING

A. Cure glazing sealants & compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

B. Protect glass from breakage immediately upon installation, by attaching crossed streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass.

C. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged in other ways during the construction period, including natural causes, accidents and vandalism.

D. Maintain glass in a reasonably clean condition during construction so that it will not be damaged by corrosive action and will not contribute (by wash off) to the deterioration of glazing materials and other work.

E. Polycarbonate materials shall be cleaned using a mild detergent (such as Formula 409) and lukewarm water. Use a clean, soft cloth or sponge, rinse well with clean water.

F. Paint splashes can be removed using VM&P Naphtha, isopropyl alcohol, or butyl cellosolve, or as otherwise recommended by the glazing manufacturer. Do not use butyl cellosolve in direct sunlight.

G. DO NOT use abrasives, paint scrapers, razor blades, or squeegees on polycarbonate. Benzene, gasoline, acetone, or carbon tetrachloride should not be used on either polycarbonate or mar resistant polycarbonate.

H. Cleaning instruction coordination shall be the responsibility of the general contractor. The glazier manufacturer, painter, and other trades shall be informed of all cleaning instructions.

I. Wash and polish glass on both faces not more than four (4) days before date scheduled for inspections that establish date of Substantial Completion. Comply with security glazing manufacturer's cleaning recommendations. These washing and polishing efforts shall be done by a professional cleaning/custodial firm.

END OF SECTION 111950

SECTION 111960 - SECURITY HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUMMARY

A. Detention Equipment Contractor (DEC):
   1. Provide security hardware as indicated in the schedules and as specified herein.
   2. Refer to Detention Door Schedule and door details; Custom/Security Hollow Metal Work Section 111910, and Security Control System Section 285000.
   3. Coordinate Security Hardware installation with electrical requirements provided by the Electrical Contractor.
   4. Make final electrical control hookups at door and control panels.
   5. Coordinate all Security Hardware and electrical control needs required with other subcontractors and their equipment to have it function properly from the remote Security Control Consoles (e.g. overhead doors, architectural passage doors).
   6. Furnish to the General Contractor any security hardware required for installation on Architectural Hollow Metal doors and frames. Provide necessary templates, etc. for installation.

B. General Contractor:
   1. Coordinate installation of security hardware with DEC, Security Control System Contractor (SCSC) and Electrical Contractor.
   2. Install on Architectural doors and frames any required security hardware being provided by the Security Control System Contractor (SCSC).

C. Electrical Contractor:
   1. Coordinate electrical requirements with General Contractor, DEC and SCSC.
   2. Provide all security control wiring, conduit, fittings, back boxes and junction boxes, as directed by Security Control System Subcontractor.
   3. Provide all power wiring, conduit, fittings and mortar boxes as required for equipment described within this section.

1.3 ACTION SUBMITTALS

A. Required submittal for Security Hardware shall be submitted as a complete package. Failure to do so will result in the submittal being "Rejected" and returned.

B. Manufacturer's Data:
   1. Submit one (1) reproducible (digital format) copy of product specifications, fabrication and installation instructions for each hardware item used.

C. Shop Drawings:
   1. Shop drawings submittals for Security Hardware shall be submitted as an entire section.
   2. Submit one (1) reproducible (digital format) copy of a horizontal hardware schedule, including all miscellaneous items. Give openings by door number and location,

manufacturer's names, catalog numbers, keying information, materials, and finish in the scheduling sequence and format as recommended by security hardware manufacturer.

3. The Architect's approval of the hardware schedule will not relieve the Contractor or Supplier of responsibility for errors or omissions that it might contain.
4. A Security Hardware Coordination Conference shall be held and coordinated by the General Contractor after the first Shop Drawing submittal of the Security Hardware. All participants should have at least one (1) week worth of review of this first Shop Drawing submittal and be prepared to comment on its appropriateness for their assigned job efforts.
5. All security keying shall be reviewed with the Owner and approved during the Shop Drawing submittal review meeting.

D. Samples and Templates:

1. Furnish to manufacturer of hollow metal doors and frames as required for proper reinforcement and preparation of their work.
2. If required, the Hardware Supplier shall furnish physical hardware and backboxes to the door and frame manufacturer for inclusion into door and frame fabrications.

E. Security Keying Chart/ Schedule:

1. Submit a Keying Chart schedule after both the Architect and Owner/User have approved the security keying shop drawings. Refer to articles titled "Cylinders, Keys, and Keying" and "Key Control" near the end of this Section.

F. Maintenance Manual

1. Submit two (2) bound Maintenance and Repair Manuals, complete with detailed parts drawings, for all manual and energized security hardware products supplied in this section.
2. Provide on-site review of these manuals and spare parts with the Owner's designated representative during training period. Refer to Article 1.6 "Training" ahead.

G. Refer to Specification Section 111900 for additional submittal requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver all items in manufacturer's original packaging. Individually package and carefully mark each item for intended opening and use. Each item complete with all necessary screws, bolts, keys, instructions, and where necessary, installation templates.

B. Storage: Store items off floor in dry area of building out of way of other work in progress. Provide maximum protection against loss and damage.

C. Handling: Handle all items in a manner as to prevent damage.

1.5 GUARANTEE

A. Upon Final Completion, the Manufacturer/Installer shall provide a written warranty covering the security hardware against defective materials and workmanship and guaranteeing satisfactory operation and performance for a period of one (1) year after Final Completion. The Manufacturer/Installer shall make necessary adjustments and replace any defective or broken parts caused by defective mechanical parts.

1.6 TRAINING

A. Provide one (1) eight-hour day for training of Owner personnel for maintenance and repair of all security hardware. Training shall be at Owner's convenience prior to Final Completion.

B. Training class and agenda shall include hands-on teaching of repair and maintenance. Contractor shall provide all equipment and tools necessary to conduct training for Owner's personnel.

C. Training shall be conducted by employee of security hardware manufacturer or factory-authorized service representative with over five years of experience maintaining/repairing locks of the type installed in this facility.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Catalog numbers of the first manufacturer listed have been used to establish the quality required. Other manufacturers seeking approval shall do so in writing per General Requirements and shall list exact catalog numbers and description of the items he proposes to furnish:

ITEM				
1.	Hinges	Southern/Folger	Airteq	Stanley
2.	Stops	Airteq	Northwest	
3.	Holders, Surface Bolts	Glynn–Johnson	Yale	
4.	Push, Pull	Southern/Folger	Airteq	Brink
5.	Thresholds	Pemko	NGP Reese	Zero
6.	Weatherstrip	Pemko	Reese	Zero
7.	Security Locks	Southern/Folger	Airteq	Brink

B. Designations: Following abbreviations identify listed manufacturers:

1.	Southern/Folger	Southern/Folger Co.; San Antonio, TX
2.	Airteq	Cornerstone Detention; Montgomery AL
3.	Brink	R.R. Brink Lock Systems, Inc.; Shorewood, IL
4.	Glynn–Johnson	Glynn–Johnson Corp.; Chicago, IL
5.	Hager	Hager Hinge Co.; St. Louis, MO
6.	Ives	H. B. Ives Div.; New Haven, CT
7.	LCN	LCN-Allegion
8.	NGP	National Guard Products
9.	Northwest	Northwest Specialty Hdwr Inc.; Clackamas, OR
10.	Norton	Norton Closer Div.; Charlotte, NC
11.	Pemko	Pemko Mfg. Co.; Emeryville, CA
12.	Reese	Reese Enterprises; Rosemount, MN
13.	Rockwood	Rockwood Manufacturing Co.; Rockwood, PA
14.	Stanley	Stanley Black & Decker; New Britain, CT
15.	Zero	Zero Weatherstripping; Bronx, NY

2.2 MATERIALS

A. Screws, Fasteners, and Tools:

1. Provide exposed fasteners to match material/finish of item being fastened. Make fastener of the same metal as item fastened, except use plated brass or stainless steel for all aluminum items. Provide twenty (20) spares of each type of fastener used for anchoring hardware.

2. Provide Torx-head (with center reject pin) security fasteners for exposed fasteners on all security hardware, regardless of manufacturer. Furnish six (6) tool holders and six (6) bits

for each different size screw. Holders and bits shall be left at the project after fastener installation and become the property of the user.

3. Provide two (2) alignment tools for medium security locks.

B. **Hinges**:

1. Heavy Duty, 4 1/2 FM – ICS:
   a. Series/Manufacturer:
      1) 204 FMSS / Southern Steel Co.
      2) 604 FMCS / Airteq
      3) No.4 1/2"-ICS Prison / Brink
   b. Description:
      1) 4 1/2 x 4 1/2, 3/16" thick leaves.
      2) Cast stainless steel leaves, non-removable stainless steel pins, stainless steel ball bearings, three knuckle with "HT" hospital tips.
      3) Provide with a 1/2" long steel stud on each leaf.
   c. Provide quantities as follows:
      1) Doors less than 5 feet high - one pair.
      2) Doors over 5 feet to 7 feet 6 inches high - 1-1/2 pairs.
      3) Doors over 7 feet 6 inches high - 2 pair
      4) Doors 3 feet 6 inches wide and over - 2 pairs.
      5) Doors 4 feet 6 inches wide and over – 2-1/2 pairs.

2. Continuous Hinge (Plain Surface Type):
   a. Series/Manufacturer:
      1) 4000 Series / Braun Mfg. Co., Inc. (www.hinge1.com)
      2) Approved Equal
   b. Description:
      1) Hinge Leaf material - Cold Rolled Steel
      2) Hinge Pin material - Steel
      3) Shapes and lengths and gauges to be custom modified as required and/or as indicated on drawings.
      4) Provide quantities as indicated on the drawings and hardware sets.
      5) Provide USP primed.

C. **Door Position Switches**:

1. Magnetic Switch (Full-Mortise in frame head):
   a. Series/Manufacturer:
      1) 200 MRS TB/Southern Steel Co.
      2) 6200/Airteq
      3) 201023/Brink
   b. Mortise installation overhead mounting with switch contacts housed in the door frame and actuating magnet mortised into the top of the door.

D. **Security Locks:**

1. Maximum Security - Motor Operation:
   a. Series/Manufacturer:
      1) 10120AM/Southern Steel Co.
      2) 9912M/Airteq
      3) 5026M x MCLH-M/Brink

b. Frame mounted 24 VDC, continuous duty motor actuated.
c. Bolt is retracted by energized motor by a push-button at control panel and remains retracted until door is opened.
d. Bolt is retracted manually by key from outside and inside or outside only.
e. Provide galvanized at exterior installations.
f. Provide interlock feature as required.
g. Internal switches monitor status of bolt.
h. Provide key cylinder extension where keyed both sides.

2. Medium Security - Motor Operation:
   a. Series/Manufacturer:
      1) 10300M/Southern Steel Co.
      2) 9424/Airteq
      3) 3520-300 x ____/Brink
   b. Security Grade: ASTM F 1577 Grade 1.
   c. Frame mounted 24 VDC high torque gear motor.
   d. Latchbolt retracts when motor is energized and remains retracted until the door is opened.
   e. Mechanically unlocked by key outside and inside or outside only.
   f. Provide keeper with built-in limit switch; internal switches to monitor status of deadlock.
   g. Provide interlock features as required.
   h. Provide key cylinder extension where keyed both sides.

3. Medium Security - Mechanical Operation: Food Pass Lock
   a. Series/Manufacturer:
      1) 1017AM/Southern Steel Co.
      2) 5017M/Airteq
      3) 7017M/Brink
   b. Keyed outside only.
   c. Reverse bolt bevel at food pass locations. Refer to details on Drawings.

4. Medium Security - Mechanical Operation: Paper Pass Lock
   a. Series/Manufacturer:
      1) 1017AM/Southern Steel Co.
      2) 5017M/Airteq
      3) 9025/Brink
   b. Keyed outside only.
   c. Refer to details on Drawings

E. **Closers**: (Recess Mounted)
1. Series/Manufacturers:
   a. 2210 Series/LCN
   b. 7970 Series/Norton
2. Description:
   a. Provide recessed door head closers unless noted otherwise.
   b. All door closers shall be by one manufacturer and carry a fifteen (15) year warranty, except electrical components, which will carry a two-year warranty. All door closers

shall be inspected, after installation, by a factory representative to insure their proper adjustments and operations.

c. Spring power shall be adjustable. Spring power shall provide an opening force range of 8 to 15 pounds from 0 degrees to 90 degrees.

d. Closers shall have separate adjustments for latch speed, general speed, and back check.

e. Provide accessories required to insure a proper installation.

F. **Pull Loop**:

1. Series/Manufacturers:
   a. 212-C/Southern Steel Co.
   b. 612/Airteq
   c. 300021/Brink
2. Stainless steel. Overall length 8-3/4" x 1-1/2" clearance. Fasteners shall be 2-3/8" - 6 x 3/4" stainless steel Torx-head security screws with center reject pin.

G. **Pull Flush**:

1. Series/Manufacturer:
   a. 214-S/Southern Steel Co.
   b. 614/Airteq
   c. 300011/Brink
2. Stainless steel, 4" wide, 1/8" thick x 5" high. Fasteners shall be 1/4" 20 x 5/16" stainless steel Torx-head security screws with center reject pin.

H. **Push/Pull Plate**:

1. Series/Manufacturer:
   a. 120L/Hager
   b. 1456/Hiawatha
   c. 91-RKW/Rockwood
2. 1/8" thick stainless steel, 3.5" w x 16" h with 7/8" lip projection at bottom. Attach with stainless steel Torx-head security screws with center reject pin.

I. **Door Stops**:

1. Series/Manufacturer:
   a. 650/Airteq (wall or floor)
   b. 606S/Northwest (wall or floor)
   c. 3001/ Stanley (floor); 3002/ Stanley (wall)
   d. 467/Rockwood (wall or floor)
2. Silicone rubber body, 2" diameter. 2-1/2" (3-1/2") high.
3. 5/8" x 2-1/2" diameter mounting shank.
4. Embedded in wall or floor with epoxy resin adhesive.

J. **Thresholds**: (Exterior and Anti-Pass)

1. Series/Manufacturer:
   a. 950/NGP
   b. 2010_PK/ Pemko
   c. S257/ Reese
   d. 566/ Zero
2. Provide anti-pass thresholds as indicated in the Detention Door Schedule.
3. Provide aluminum mill finish, unless noted otherwise.
4. Set the aluminum threshold into a full bedding of mastic and secured with stainless steel Torx-head security screws with center reject pin.

5. Threshold shall be ADA compliant.
6. Threshold shall prevent the passing of paper or other contraband under the door.

K. **Weatherstripping/Sound Seals**:
1. Series/Manufacturer:
   a. 305CR x 315CN/Pemko
   b. DS70C x 362/Reese
   c. 50 x 339 (modified to receive a sweep)/Zero
2. Extruded anodized aluminum with neoprene seal, secured with stainless steel Torx-head security screws with center reject pin.

L. **Weatherstripping/Sound Seals (Bulb type):**
1. Series/Manufacturer:
   a. S88/Pemko
   b. 5050/NGP
   c. 188S/Zero
2. Self-adhesive silicone rubber perimeter seal.

M. **Automatic Door Bottom**:
1. Series/Manufacturer:
   a. 420ASL/Pemko
   b. 372/Reese
   c. 360/Zero
2. Mortised type, cam-actuated drop down silicone seal, with spring mechanism return.

N. **Kickplates**:
1. Series/Manufacturer:
   a. 194S/Hager
   b. K1050/Rockwood
2. Kickplates shall be 0.050" stainless steel with eased edges. 10" high (except reduce height 1/2" less than bottom rail when required) x 2" less than door width on singles and 1" less on pairs. Fasteners shall be full threaded, oval, undercut, metal screw; Torx-head security screws with center reject pin.

O. **Door Silencers**:
1. Series/Manufacturer:
   a. GJ-64/Glynn-Johnson
   b. 608/Rockwood
   c. SR64/Ives
2. Provide three (3) silencers per door. Silencer design forms an air pocket to absorb shock and reduce noise of door closing. Once installed, the silencers should be tamper-proof and eliminate door rattle.

P. Security Hardware Finishes:

	U.S. Symbol	ANSI Symbol	Description
1. Hinges, Exterior	US32D	630	Satin Stainless Steel
2. Hinges, Interior	US32D	630	Satin Stainless Steel
3. Locks and Pulls	US26D	626	Satin Chromium
4. Closers	AL	689	Aluminum Painted
5. Push, Kick	US32D	630	Satin Stainless Steel
6. Door Pulls	US32D	630	Satin Stainless Steel
7. Escutcheons	US32D	630	Satin Stainless Steel

2.3 CYLINDERS, KEYS, AND KEYING

A. The security locks will incorporate two (2) keying systems, one for pin tumbler (mogul cylinder) locks and one for builder's hardware high security six-pin tumbler cylinder locks. Dye stamp each keying system's keys for identification, corresponding to the final/approved Keying Chart.
   1. Review all security keying with Owner for final approval during submittal phase.
   2. Provide ASSA mortise and Mogul cylinders for detention locks.
   3. Provide a system of keys and matching locks that are color-coded and marked for identification by touch to comply with "sight and touch" requirements in 2018 Virginia Statewide Fire Prevention Code section 403.8.3.4.
   4. Key Food Pass locks alike and provide ten (10) keys with dye stamp identification marking.
   5. Key Paper Pass locks alike & provide ten (10) keys with dye stamp identification marking.
   6. Master key mogul cylinder locks as indicated in Detention Door Schedule and as confirmed with the Owner during the Security Keying Meeting.
   7. Provide two (2) keys in each Key Cabinet for all individual key designations.
   8. Provide three (3) keys in each Key Cabinet for each Master key designation.
   9. Provide a complete, detailed, schematic Keying Chart of the Security Keying System's individual key designations.
      a. Two (2) copies of this Keying Chart, overlaid on an architectural floor plan print, shall be turned over to the Owner/User at the completion of the project. The cost for Keying Chart shall be included with the cost of materials at the time of bidding.

B. Key Control:
   1. Provide one (1) Key Cabinet in Control Room 164. Coordinate exact location with Owner and other equipment to be wall-mounted in the control room.
   2. Key Cabinet (wall mounted, surface):
      a. Key Control system shall be furnished with a capacity of 1.75 times the number of individual key designations and shall be a complete dual tag system.
      b. Key Cabinet shall have concealed-type hinge and rounded sides.
      c. Panels must have individual hooks and label pockets formed as an integral part of the panel, for each key type, as required. (i.e. mogul, M-_; builders hardware, B-_).
      d. Key Tags of two (2) types shall be provided, one tag to attach to the individual key designations that permanently stays in the key cabinet and one tag to attach to the individual key designation that is loaned out.
      e. Indexing shall be provided to record information concerning locks and keys alphabetically.
      f. Permanent Loan Registry shall be furnished to protect identity of key borrowers while Receipt Tabs shall be supplied for temporary loan.
   3. Keys shall not leave the manufacturer's custody without prior arrangements for delivery and authorization from the Owner.

2.4 SECURITY HARDWARE SETS FOR SECURITY/DETENTION DOORS

A. Provide security hardware equal to items scheduled. Verify electrical devices are appropriate for models indicated. Electrical control connections are included in work of Section 285000 "Security Control System."
   1. Smoke seals and automatic door bottoms shall be added to all doors in smoke barriers as required to meet smoke and fire ratings per UL 1784.
   2. **Food Pass**
      a. All doors indicated with food passes in the Options column of the Detention Door Schedule shall have the following additional hardware:

1 Braun Hinge – 4807-E
1 Food Pass Lock, Southern Steel 1017AM

B. Security Hardware Sets Schedule:

HARDWARE SET NO	QUANTITY	CLASS	DESCRIPTION
SH1	3	Hinges	SS 204FMSS
	1	Lock	SS 10120AM x K2 x KCE
	2	Loop Pulls	SS 212C
	1	Door Closer	LCN 2210
	1	Door Position Switch	SS 200MRS TB
	1	Door Bottom Sweep/Rain Drip	Pemko 345A
	1	Threshold	Pemko 2010_PK
	1	Door Stop	Airteq #650
	1	Kickplate	
	1	Auto Bottom	Pemko 420ASL
	1	Weatherstrip	Pemko 305CR
SH2	3 or 4	Hinges	SS 204FMSS
	1	Lock	SS 10120AM x K2 x KCE
	2	Loop Pull	SS 212C
	1	Door Closer	LCN 2210
	1	Door Position Switch	SS 200MRS TB
	1	Door Stop	Airteq #650
	1	Kickplate	
	1	Auto Bottom	Pemko 420ASL
	1	Weatherstrip	Pemko 305CR
SH2A	3 or 4	Hinges	SS 204FMSS
	1	Lock	SS 10120AM x K2 x KCE
	1	Loop Pull	SS 212C
	1	Flush Pull	SS 214S
	1	Door Closer	LCN 2210
	1	Door Position Switch	SS 200MRS TB

	1	Door Stop	Airteq # 650
	1	Auto Bottom	Pemko 420ASL
	1	Weatherstrip	Pemko 305CR
SH3	3	Hinges	SS 204FMSS
	1	Lock	SS 10120AM x K1
	1	Loop Pull	SS 212C
	1	Flush Pull	SS 214S
	1	Door Position Switch	SS 200MRS TB
	1	Door Stop	Airteq # 650
	3	Silencers	
SH4	3	Hinges	SS 204FMSS
	1	Lock	SS 10120AM x K2 x KCE, Provide no mechanical latch hold back function
	2	Loop Pull	SS 212C
	1	Door Closer	LCN 2210
	1	Door Position Switch	SS 200MRS TB
	1	Door Stop	Airteq #650
	1	Kickplate	
	1	Auto Bottom	Pemko 420ASL
	1	Weatherstrip	Pemko 305CR
	1	Jamb-mounted Push Button (for local lock operation)	Airteq # 6300 (mount inside Control Room)
SH5		(NOT USED)	
SH6		(NOT USED)	
SH7	3	Hinges	SS 204FMSS
	1	Lock	SS 10300M x K2 x KCE
	1	Loop Pull	SS 212C
	1	Flush Pull	SS 214S

	1	Door Closer	LCN 2210
	1	Door Position Switch	SS 200MRS TB
	1	Door Stop	Airteq #650
	1	Auto Bottom	Pemko 420ASL
	1	Weatherstrip	Pemko S88
SH7A	3	Hinges	SS 204FMSS
	1	Lock	SS 10300M x K2 x KCE
	2	Loop Pull	SS 212C
	1	Door Closer	LCN 2210
	1	Door Position Switch	SS 200MRS TB
	1	Door Stop	Airteq #650
	1	Kickplate	
	1	Auto Bottom	Pemko 420ASL
	1	Weatherstrip	Pemko S88
	1	Jamb-mounted Push Button (for local lock operation)	Airteq # 6300 (mount inside room)
SH8 thru SH11		(NOT USED)	
SH12	1	Lock	SS 1050D Gate Lock x K2
	1	Gate Position Switch	GE 2707A

C. Security Spare Locks and Lock Parts:
   1. Provide the following for the Owner's stock:
      a. 1 Lock 10120AM
      b. 1 Lock 10300M
      c. 2 Mogul Cylinders
      d. 2 Builders Cylinders
   2. One each repair parts kit for each lock series, containing springs, micro switches, screws, nuts and washers.
   3. One parts kit containing an assortment (minimum 25) of all hardware security screws used on this project.
   4. One complete set of hardware security screwdrivers for all sizes of hardware security screws used on this project.
   5. One repair parts list and assembly drawings bound in a manual for all security products supplied in this section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors, frames and hardware for damage, defects, and suitability for intended use. Restore all parts or items found damaged, defective, or inadequate, or replace with good material before installation.

3.2 INSTALLATION

A. Mounting Heights:

1. Heights given are centerline heights up from finish floor unless noted otherwise; heights given "Number to Number" indicate that all shall be at one consistent height within limits given. Where heights of items are not listed, mount per recommendations of DHI.

a.	Bottom hinge	10 to 13 inches
b.	Top hinge	6 to 8 inches down from head
c.	Intermediate hinges	Equally spaced
d.	Door knobs	36 to 40 5/16 inches
e.	Door pull	42 to 48 inches
f.	Deadlocks	54 inches floor to centerline

B. Fitting:

1. Fit all hardware accurately and properly.
2. Remove exposed parts until after painting is completed. Then reinstall.
3. Securely fasten all fixed parts.
4. Fit faces of mortised parts snug and flush.
5. Ensure operating parts move freely and smoothly without binding, sticking, or excessive clearances.

C. Adjusting and Finishing:

1. After work has been otherwise completed, examine all hardware for complete and proper installation.
2. Lubricate bearing surfaces of moving parts
3. Adjust latching and holding devices to proper function
4. Adjust door closer devices for proper speed and power.
5. Test keys for conformance to approved Keying Chart system.
6. Clean all exposed surfaces, check for surface damage and then polish.

D. Thresholds:

1. Install in one continuous piece, full width of opening. Set in full bed of sealant and fasten with countersunk anchors at 6 inches on center with Torx-head security screws with center reject pin.

3.3 DEFECTIVE WORK

A. Where hardware is found defective in materials or installation; rework, restore, replace, or otherwise correct as directed.

B. The following will be considered as defective materials:

1. Unauthorized substitutions.
2. Items delivered with missing, broken, damaged or defaced parts.
3. Items of incorrect hand or function.

C. The following will be considered as defective installation:

1. Items broken, damaged, or defaced after delivery.
2. Items incomplete, misaligned or incorrectly located.

D. All expenses incurred by the Architect in troubleshooting the Security Hardware Work, caused by inadequate workmanship or other form of non-performance on the part of the subcontractor, shall be borne by that subcontractor.

END OF SECTION 111960

SECTION 122400
WINDOW SHADES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

B. Sequencing:

1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
2. Do not install shades until final surface finishes and painting are complete.

1.03 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

B. 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.

C. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.

D. Selection Samples: Include fabric samples in full range of available colors and patterns.

E. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

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 Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Authorized installation representative of fabricator/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 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following minimum terms:
   1. Manual Operating Mechanism / Clutch: 10 years, minimum (excludes bead chain).
   2. Fabric: 10 years, minimum.
   3. Balance of Shade Hardware and Non-Operating Materials and Components: 25 years, minimum.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade.
   2. Hunter Douglas Architectural; RB500 Manual Roller Shades.
   3. Lutron Electronics Co., Inc; Contract Roller Manual Roller Shades.
   4. MechoShade Systems LLC; Mecho/5 System.
   5. WT Shade; HeliaRise.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Source Limitations: Provide products produced by a single manufacturer and obtained from a single supplier.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades:
   1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
      a. Drop Position: Regular roll.
      b. Roll Direction: Roll down, closed position is at window sill.
      c. Mounting: Window jamb mounted - inside, between jambs.
      d. Size: As indicated on drawings for rough opening sizes; field verify rough openings prior to fabrication.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   3. Roller Tubes: As required for type of shade operation.
      a. Material: Extruded aluminum, clear anodized finish or electrogalvanized/epoxy primed steel, as standard with manufacturer.
      b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c. Fabric Attachment: Utilize manufacturer's standard method for attaching shade fabric material to rollers.
   4. Hembars: Designed to maintain bottom of shade straight and flat.

a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.

5. Manual Operation for Interior Shades:
   a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
   b. Drive Chain: Continuous loop beaded ball chain, 95 pounds minimum breaking strength. Provide upper and lower limit stops.
6. Accessories:
   a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
   b. End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.
   c. Ceiling Pockets with Prewired Raceway: UL 325 listed, extruded aluminum shade pocket with removable closure panel and ceiling tile support, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
      1) Products:
         (a) Armstrong Celings; Axiom Building Perimeter System (Basis of Design)
         (b) USG; COMPÄSSO Elite Curtain Pockets
         (c) MechoShade Systems LLC
   d. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. Fabric: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Manufacturers:
      a. Lutron Electronics Co., Inc; Basketweave 27 - 1% .
      b. Mermet Corporation; E-Screen - 1%.
      c. Phifer, Inc; Style 2500 1%.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Material: Vinyl coated fiberglass.
   3. Performance Requirements:
      a. Flammability: Pass NFPA 701 large and small tests.
      b. Fungal Resistance: No growth when tested according to ASTM G21.
   4. Color: To be selected by Architect from manufacturer’s full range.
   5. Fabrication:
      a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
      b. If height of opening requires multiple panels of railroaded fabric, use manufacturer's standard sewn seams.

2.04 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 1/4 inch maximum space between bottom bar and window stool.
   2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb, with maximum 1/4 inch gap at each edge of 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 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION 122400

SECTION 126723
COURTROOM BENCH SEATING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

C. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Manufacturers seeking consideration as an acceptable alternative to the named manufacturers for specified courtroom seating and wood benches must submit samples, details, technical materials, fabrication specifications, and performance criteria to the Architect a minimum of 30 days after award of Contract in accordance with the General Conditions and Division 1 Sections "Substitution Procedures" and "Product Requirements". Materials not meeting all product, technical, and performance criteria will not be considered.

1.03 SUBMITTALS

A. Product Data: Manufacturer's printed data sheets for products specified.

B. Shop Drawings: Fabrication and installation details including seating and end panel styles, layouts and dimensions, aisle widths and row spacing.

C. Selection Samples: Manufacturer's color charts and swatches for hardwood and finishes, indicating full range of materials, colors, and patterns available.

D. Verification Samples: Provide material samples for each wood type, including all accessories and end panel finishes, illustrating all finishes and workmanship to be expected in the finished Work.

1. For each solid wood or wood veneered product indicated to receive transparent finish, provide at least three samples illustrating standard range of wood grain, stain color, and sheen, for selected color.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced, locally-based installer with regular experience in the installation of courtroom, church, and theater style seating.

B. Seating Layout: Design and fabricate seating such that intermediate seating supports are equally spaced, and intermediate supports and end panels are aligned from first row to last row.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver seats to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store seating units in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.06 FIELD CONDITIONS

A. Verify seating unit dimensions through the use of field measurements prior to fabrication.

B. Do not install seating until HVAC is operating at occupancy conditions and interior floor finishes are complete.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Bench Spectator Seating:
   1. Sauder Manufacturing Company (Basis-of-Design Manufacturer).
   2. New Holland Custom Woodwork Ltd. (subject to specified requirements)
   3. Ratigan-Schottler Mfg. Co. (subject to specified requirements)

B. Source Limitations: Provide all spectator bench seating by one manufacturer.

2.02 MATERIALS

A. Cast Iron: ASTM A48/A48M, Class 25A minimum, free of air holes and casting imperfections, all edges ground smooth.

B. Sheet Steel: ASTM A879/A879M, Commercial Steel (CS) or Drawing Steel (DS) electrogalvanized sheet, 04Z (12G) coating class on both surfaces; chemically treated for baked enamel finish.

C. Steel Plates, Bars, and Tubes: ASTM A36/A36M.

D. Exposed Hardwood: Solid lumber selected for absence of visible defects; species as indicated.

E. Concealed Plywood: Veneer-core plywood; particleboard-core plywood is not acceptable. Provide hardwood plywood in compliance with ANSI/HPMA HP or softwood plywood in compliance with ANSI PS 1, as standard with seating manufacturer.

F. Expansion Anchors: Expansion anchors complying with GSA A-A-1923 A, Type 4, or comparable, as required by seating manufacturer for specified concrete substrate and installation conditions.

G. Wood Screws: Flat head carbon steel; length and type as required by seating manufacturer for substrates and fabrication/installation requirements.

2.03 COURTROOM BENCH SEATING

A. Fixed seating system designed using aligned intermediate supports in each row and with aligned end panels. Fabricate seating with ergonomic contoured forms for maximum comfort, with materials selected to be free from defects, projections, or irregularities. Smoothly round corners and edges, and use concealed, rounded, or countersunk fasteners to prevent snagging or pinching hazards due to projections.

B. Courtroom Bench Seating: Veneered construction, with high pressure laminated core construction, hardwood veneer, and lumber moldings. Provide formed veneer-core plywood construction panel material for seat and back construction. Solid lumber or particleboard seat and back construction will not be considered.
   1. Basis-of-Design Bench: Sauder Manufacturing Co.; Model #301-4016.
   2. End Panel: One piece panels fastened securely to aisle standards with concealed fasteners.
      a. Basis-of-Design: For bid purposes provide equivalent to Sauder Manufacturing Co.; Model #302-1305 rectangular end with raised panel. Provide full range of options to Architect for verification, including manufacturer's "endless" option without end panel.
      b. Edge molding profiles shall be selected by Architect from manufacturer's full range.
   3. New Holland Custom Woodwork Ltd. bench body model 50-LS is acceptable subject to provision of "apron" trim piece at rear underside of caprail, and provision of a like-design

end panel to match basis-of-design specified.

C. Hardwood Veneer and Stained Finish: Selected by Architect from manufacturer's full range.

2.04 FINISHES

A. Ferrous Metals: Manufacturer's standard two-coat baked enamel finish, applied over conversion coating appropriate to base metal.

B. Hardwood: Manufacturer's standard clear low-gloss finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of bench seating. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's installation instructions and approved shop drawings.

B. Locate bench seating in locations as indicated on approved shop drawings, with required clearances, elevations, and sight lines.

C. Install bench seating directly over carpet or other finish flooring as indicated.

1. Do not install bench seating until finish flooring installation is complete and approved.
2. Protect flooring and other adjacent finishes during seating installation.
3. Provide installation methods that will not damage finish flooring. Do not drag or slide seating over flooring.
4. Provide for repair or replacement of flooring that is damaged by the work of this section.

3.03 CLEANING AND PROTECTION

A. Repair minor abrasions and imperfections in finishes with a coating that matches factory-applied finish; replace units that cannot be repaired to unblemished appearance.

B. Protect installed seating for the duration of construction.

END OF SECTION 126723

SECTION 142400
HYDRAULIC ELEVATORS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. AISC 360 - Specification for Structural Steel Buildings.

C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices.

D. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, and Dumbwaiters.

E. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

I. AWS D1.1/D1.1M - Structural Welding Code - Steel.

J. {RSTEMP#1686}ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.{CH#188509}.

K. NEMA LD 3 - High-Pressure Decorative Laminates.

L. NEMA MG 1 - Motors and Generators.

M. NFPA 70 - National Electrical Code.

N. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

O. UL (DIR) - Online Certifications Directory.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other installers for construction of hoistway to ensure hoistway is built to elevator manufacturer's requirements, including but not limited to, the following:
      a. Concrete work for elevator pit depth, hoistway size, and sump requirement.
      b. Masonry and/or metal framing and gypsum shaft wall for hoistway size, wall depth, and fire rating.
      c. Metal fabricator for sizing and location of hoist beam.
   2. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
      a. Elevator equipment devices remote from elevator hoistway.
      b. Emergency communication service.
      c. Elevator pit for lighting and sump pump.
      d. Automatic transfer switch.

e. Fire alarm panel.

3. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:
   a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.
   b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation.
   c. Overcurrent protection devices selected to achieve required selective coordination.

B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
   1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

C. Construction Use of Elevator(s): Not permitted.

1.03 SUBMITTALS

A. Product Data: Submit data on following items:
   1. Signal and operating fixtures, operating panels, and indicators.
   2. Car design, dimensions, layout, and components.
   3. Car and hoistway door and frame details.
   4. Electrical characteristics and connection requirements.

B. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
   1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
   2. Hoistway Components: Size and location of hoist beams, car guide rails, buffers, jack unit and other components.
   3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   4. Loads on hoisting beams.
   5. Clearances and over-travel of car.
   6. Locations in hoistway of traveling cables and connections for car lighting and telephone.
   7. Location and sizes of hoistway and car doors and frames.
   8. Interface with building security and access control systems.
   9. Electrical characteristics and connection requirements.
   10. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.

C. Samples: Submit samples illustrating car interior finishes in the form of cut sheets or finish color selection brochures.

D. Designer's Qualification Statement.

E. Installer's Qualification Statement.

F. Testing Agency's Qualification Statement.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Initial Maintenance Contract.

I. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as

indicated, starting on date initial maintenance contract/war is scheduled to expire.

1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

J. Operation and Maintenance Data:

1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
2. Operation and maintenance manual.
3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design guide rails, brackets, anchors, and machine anchors under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Installer Qualifications: Company specializing in performing the work of this section and approved and certified by elevator equipment manufacturer.

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.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

E. Products Requiring Fire Resistance Rating: Listed and classified by {\rs\#1}, UL (DIR), or testing agency acceptable to authorities having jurisdiction.

F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: TK Elevator; endura.

B. Other Acceptable Manufacturers - Hydraulic Elevator Manufacturers (provide substitution request with full data per requirements below):

1. Alliance Elevator Solutions.
2. Otis Elevator Company.
3. Schindler Elevator Corporation.

C. Substitutions: See Section 016000 - Product Requirements.

1. Products other than Basis-of-Design: If submitting a substitution for a product by a manufacturer other than the Basis-of-Design, the submitting manufacturer shall provide a substitution request and provide the Contractor with changes required to indicated design and requirements, including but not limited to: hoistway dimensions, pit depth, overhead height, hoist beam size, location, and configuration, electrical characteristics, motor size, and disconnects, controller and panel locations, and rated load and speed.

a. Changes to the work due to submittal of a product other than the Basis-of-Design shall be accommodated at no additional cost to the Owner. The Contractor shall coordinate with all affected subcontractors during the bidding/pricing process to ensure accurate pricing for submitting elevator manufacturer.
b. The manufacturer, Contractor, and Architect shall coordinate changes prior to the start of construction on the hoistway. The Architect shall incorporate changes into the documents and re-issue for distribution to affected subcontractors.

2.02 HYDRAULIC ELEVATORS

A. Hydraulic Passenger Elevator, No. 1 (Public Lobby):
1. Hydraulic Elevator Equipment:
a. Holeless hydraulic with cylinder mounted within hoistway.
2. Operation Control Type: Standard single car operation.
3. Service Control Type:
a. Standard service control only.
4. Interior Car Height: 88 inch.
5. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
a. Motor Size: 30 HP.
6. Rated Net Capacity: 3500 pounds.
7. Rated Speed: 110 FPM up / 135 FPM down.
8. Hoistway Size: As indicated on drawings.
9. Elevator Pit Depth: 48 inch.
10. Overhead Clearance at Top Floor: 12' - 8" to underside of hoist beam.
11. Travel Distance and Stops: 15' - 4"; two stops in-line, front only.

B. Hydraulic Passenger Elevator, No. 2 (Staff):
1. Hydraulic Elevator Equipment:
a. Holeless hydraulic with cylinder mounted within hoistway.
2. Operation Control Type:
a. Restricted Access/Security Control: Standard single car operation, however access shall be by card reader. Coordinate with Security Control Systems Subcontractor (SCSC) for access control and system programming requirements.
1) Card Reader Operation: Landing call buttons shall be subject to card reader access, coordinate with Division 28 Access Control.
3. Service Control Type:
a. Standard service control only.
4. Interior Car Height: 88 inch.
5. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
a. Motor Size: 30 HP.
6. Rated Net Capacity: 3500 pounds.
7. Rated Speed: 110 FPM up / 135 FPM down.
8. Hoistway Size: As indicated on drawings.
9. Elevator Pit Depth: 48 inch.
10. Overhead Clearance at Top Floor: 12' - 8" to underside of hoist beam.
11. Travel Distance and Stops: 15' - 4"; two stops in-line, front only.

C. Hydraulic Passenger Elevator, No. 3 (Secure):
1. Hydraulic Elevator Equipment:

a. Holeless hydraulic with cylinder mounted within hoistway.

2. Operation Control Type:
   a. Restricted Access/Security Control: Refer to Division 28 Section "Video Graphical User Interface." Coordinate with Security Control Systems Subcontractor (SCSC) for access control and system programming requirements.
      1) Card Reader Operation: Landing call buttons shall be subject to card reader access, coordinate with Division 28 Access Control.
      2) Control Room Access Override ("Secure" and "Semi-Secure" Mode): System shall allow security personnel in designated Control Room to assume or relinquish control of detainee elevator, including call or dispatch functions and opening or closing of elevator doors.
      3) The elevator manufacturer and installer shall coordinate with SCSC and electrical contractor to provide necessary space and cutouts in elevator panels and components to allow for installation and coordination of intercom and card readers, and for installation of additional electrical conductors, contacts, and connection as required to interface with SCSC-provided access controls.
3. Service Control Type:
   a. Standard service control only.
4. Interior Car Height: 88 inch.
5. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
   a. Motor Size: 40 HP.
6. Rated Net Capacity: 4500 pounds.
7. Rated Speed: 110 FPM up / 135 FPM down.
8. Hoistway Size: As indicated on drawings.
9. Elevator Pit Depth: 48 inch.
10. Overhead Clearance at Top Floor: 12' - 8" to underside of hoist beam.
11. Travel Distance and Stops: 15' - 4"; two stops in-line, front only.

2.03 COMPONENTS

A. Elevator Equipment:
   1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70; refer to Division 26 and Electrical Drawings.
   2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.

B. Electrical Equipment:
   1. Motors: NEMA MG 1. Manufacturer shall size motor(s) specifically for this project to account for indicated load capacity, rated speed, and other factors as required.
      a. Electrical characteristics are based on motor sizes indicated above. If a different motor size is required, coordinate any necessary revisions to electrical supply with electrical contractor.
   2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70; refer to Division 26 and Electrical Drawings.
   3. Sump Pump in Pit: Refer to Division 22 and Plumbing Drawings.
   4. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
   5. Include wiring and connections to elevator devices remote from hoistway. Refer to Division 26 and Electrical Drawings.

2.04 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).

B. Accessibility Requirements: Comply with ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

D. Perform welding of steel in accordance with AWS D1.1/D1.1M.

E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

F. Perform electrical work in accordance with NFPA 70.

2.05 OPERATION CONTROLS

A. Elevator Controls: Provide landing operating panels and landing indicator panels.
   1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
   2. Landing Indicator Panels: Illuminating.
   3. Comply with ADA Standards for elevator controls.

B. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, and building management control systems.

C. Door Operation Controls:
   1. Program door control to open doors automatically when car arrives at floor landing.
   2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
   3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

D. Emergency Communication: Provide two-way communication system mounted in a control panel that will connect elevator cab to outside monitoring service. Monitoring service shall be interactive and available live 24/7.
   1. Emergency system shall activate by push button and not require use of handset.
   2. Emergency system shall include visual, text-based, and video-based system, and with a voice-only option, that is accessible to deaf, hard-of-hearing, or visually impaired individuals in accordance with applicable edition of the IBC.

2.06 OPERATION CONTROL TYPE

A. Single Automatic (Push Button) Operation Control: Applies to car in single elevator shaft.
   1. Refer to description provided in ASME A17.1.
   2. Set system operation so that momentary pressure of landing button dispatches car from other landing to that landing.
   3. Allow call registered by momentary pressure of landing button at any time to remain registered until car stops in response to that landing call.
   4. If elevator car door is not opened within predetermined period of time after car has stopped at terminal landing allow car to respond to call registered from other landing.

2.07 EMERGENCY POWER

A. Set-up elevator operation to run with building emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.

B. Building Emergency Power Supply: Supplied by backup generator; provide elevator system components as required for emergency power characteristics with phase rotation the same as for normal power.
   1. Provide transfer switches and auxiliary contacts.
   2. Install connections to power feeders.

C. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.

D. Provide operational control circuitry for adapting the change from normal to emergency power.

E. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.08 MATERIALS

A. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish.

B. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

C. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.

D. Flooring Finish: Refer to Finish Schedule and applicable Division 9 flooring section(s).

E. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.09 CAR AND HOISTWAY ENTRANCES

A. Elevator, No. 1 (Public Lobby) & No. 2 (Staff):
   1. Car and Hoistway Entrances:
      a. Hoistway Fire Rating: 2 Hours.
      b. Elevator Door Fire Rating: 1-1/2 Hours.
      c. Framed Opening Finish and Material: Brushed stainless steel.
      d. Car Door Material: Brushed stainless steel, with rigid sandwich panel construction.
      e. Hoistway Door Material: Brushed stainless steel, with rigid sandwich panel construction.
      f. Door Operation: Side opening, two speed.
      g. Door Width: 42 inches.
      h. Door Height: 84 inches.
      i. Sills: Extruded aluminum.
   2. Elevator, No. 3 (Secure):
      a. Car and Hoistway Entrances:
         1) Hoistway Fire Rating: 2 Hours.
         2) Elevator Door Fire Rating: 1-1/2 Hours.
         3) Framed Opening Finish and Material: Brushed stainless steel.
         4) Car Door Material: Brushed stainless steel, with rigid sandwich panel construction.
         5) Hoistway Door Material: Brushed stainless steel, with rigid sandwich panel construction.
         6) Door Operation: Side opening, two speed.
         7) Door Width: 48 inches.
         8) Door Height: 84 inches.
         9) Sills: Extruded aluminum.

B. Sills/Thresholds: Configure to align with frame return and coordinate with floor finish.

C. Gasketing: Provide acoustic type gasketing at hoistway doors and frames to eliminate audible noise due to car activities in the hoistway, and air pressure differential between hoistway and landing floors.

2.10 CAR EQUIPMENT AND MATERIALS

A. Elevator Car, No. 1 (Public Lobby):
   1. Car Operating Panel: Provide main; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons and alarm button.
      a. Panel Material: Integral with front return; one per car.
      b. Car Floor Position Indicator: Above door with illuminating position indicators.
      c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
   2. Flooring: Porcelain Tile; refer to Division 9.
   3. Front Return Panel: Stainless steel, brushed/satin finish to match door.
   4. Door Wall: Stainless steel, brushed/satin finish to match door.
   5. Side and Rear Walls: Plastic laminate on plywood.
      a. Reveals Between Wall Panels: Stainless steel, to match front return panel/door. Align reveal/joint locations with ceiling panel joints.
   6. Hand Rail: Stainless steel with brushed/satin finish, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
      a. Flat Bar Stock, Solid: 1/4 or 1/2 inch thick by 2 inch high.
   7. Ceiling: Suspended stainless steel ceiling panels with compact fluorescent or LED downlights centered in each panel.

B. Elevator Car, No. 2 (Staff):
   1. Car Operating Panel: Provide main; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons and alarm button.
      a. Panel Material: Integral with front return; one per car.
      b. Car Floor Position Indicator: Above door with illuminating position indicators.
      c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
   2. Flooring: Porcelain Tile; refer to Division 9.
   3. Front Return Panel: Stainless steel, brushed/satin finish to match door.
   4. Door Wall: Stainless steel, brushed/satin finish to match door.
   5. Side and Rear Walls: Plastic laminate on plywood.
      a. Reveals Between Wall Panels: Stainless steel, to match front return panel/door. Align reveal/joint locations with ceiling panel joints.
   6. Hand Rail: Stainless steel with brushed/satin finish, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
      a. Flat Bar Stock, Solid: 1/4 or 1/2 inch thick by 2 inch high.
   7. Ceiling: Suspended stainless steel ceiling panels with compact fluorescent or LED downlights centered in each panel.

C. Elevator Car, No. 1 (Public Lobby):
   1. Car Operating Panel: Provide main; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons and

alarm button.

a. Panel Material: Integral with front return; one per car.
b. Car Floor Position Indicator: Above door with illuminating position indicators.
c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.

2. Flooring: Porcelain Tile; refer to Division 9.
3. Front Return Panel: Stainless steel, brushed/satin finish to match door.
4. Door Wall: Stainless steel, brushed/satin finish to match door.
5. Side and Rear Walls: Stainless steel, brushed/satin finish to match door.
   a. Reveals Between Wall Panels: Stainless steel, to match front return panel/door. Align reveal/joint locations with ceiling panel joints.
6. Hand Rail: Stainless steel with brushed/satin finish, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
   a. Flat Bar Stock, Solid: 1/4 or 1/2 inch thick by 2 inch high.
7. Ceiling: Suspended stainless steel ceiling panels with compact fluorescent or LED downlights centered in each panel.

D. Car Accessories:
1. Certificate Frame: Stainless steel frame glazed with acrylic plastic, and attached with tamper-proof screws.
2. Protective Pads: Canvas cover, padded with impact-resistant fill material, sewn with piping edges; fire resistant in compliance with ASME A17.1; brass grommets for supports, covering side and rear walls and front return, with cut-out for control panel; provide one set at public elevator and one set at staff elevator.
   a. Pad Supports: Stainless steel studs, and mounted from top of wall panels.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that hoistway, pit, and machine room are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify location and size of machine foundation and position of machine foundation bolts.

E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components; see Section 015000 - Temporary Facilities and Controls for additional requirements.

B. Maintain elevator pit excavation free of water.

3.03 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.

B. Install system components, and connect equipment to building utilities.

C. Provide conduit, electrical boxes, wiring, and accessories; refer to Division 26 and Electrical Drawings.

D. Install hydraulic piping between cylinder and pump unit.

E. Mount machines, motors, and pumps on vibration and acoustic isolators.

1. Place on structural supports and bearing plates.
2. Securely fasten to building supports.
3. Prevent lateral displacement.

F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.

H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.

I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.

J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

K. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.

L. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.

B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide Acceptance Testing and inspections by regulatory agencies certified in accordance with ASME QEI 1.

1. As a part of final acceptance of the project and in accordance with the General Conditions, the Contractor shall have a Qualified Elevator Inspector (QEI) conduct a full Acceptance Inspection and Test in accordance with ASME/ANSI A17.1 before final acceptance by the Owner. The Contractor shall obtain from the elevator contractor and/or manufacturer and furnish to the Owner all data affecting the elevator installation or modification, including "as-installed" circuit and control wiring diagrams and maintenance manuals.
2. The elevator installer shall coordinate and participate with all tests, inspections, and approvals required by the building code, including but not limited to inspections by QEI, fire marshal and elevator inspector. The elevator installer shall attend and assist with tests, inspections, and approvals required by the building code at no additional cost to the Owner.
3. Schedule tests with agencies and notify Owner and Architect.
4. Obtain permits as required to perform tests.
5. Document regulatory agency tests and inspections in accordance with requirements.
6. Perform tests required by regulatory agencies.
7. Furnish test and approval certificates issued by authorities having jurisdiction.

3.06 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.

B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.07 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components in accordance with manufacturers written instructions.

3.08 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

B. See Section 017900 - Demonstration and Training for additional requirements.

C. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, cleaning and maintenance of each component.

D. Training: Train Owner's personnel on cleaning and operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Location: At project site, unless noted otherwise.

3.09 PROTECTION

A. Do not permit construction traffic within car after cleaning.

B. Protect installed products until Date of Substantial Completion.

C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.10 MAINTENANCE

A. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 12 months from Date of Substantial Completion.

B. Submit proposal for continuation of Maintenance Contract beyond the initial 12 month contract in accordance with ASME A17.1 and requirements as indicated for installed elevator equipment.

C. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or original installer.

D. Maintenance contract services shall not be assigned or transferred to any agent or other entity without prior written consent of Owner.

E. Include systematic examination at maximum monthly intervals (12 visits total for initial contract). Examination shall include adjustment, lubrication, and other preventive maintenance, and repair or replacement of defective or worn parts or equipment. Monthly inspection shall include Phase II Fire Recall testing.

F. Perform work without removing cars from use during peak traffic periods.

G. Provide emergency call back service during regular working hours throughout period of this maintenance contract.

END OF SECTION 142400

SECTION 210500 - COMMON WORK RESULTS FOR FIRE-SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors.

C. Exposed, Exterior Installations: Exposed to view outdoors.

D. Subject to Freezing: Subject to temperatures below 40 degrees F.

E. Concealed, Interior Installations: Concealed from view and protected from physical contact by occupants.

F. Concealed, Exterior Installations: Concealed from view and protected from physical contact by occupants.

G. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.

H. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.3 QUALITY ASSURANCE

A. Equipment and appliances comprising portions of the mechanical systems regulated by the International Mechanical Code shall be listed and labeled in accordance with the current edition of the Virginia Building Code.

B. Equipment and appliances comprising portions of the fire suppression systems regulated by the NFPA 13 shall be installed in accordance with the listing and the manufacturer's installation instructions. Manufacturer's installation instructions shall be available on the job site for use and inspection.

C. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

D. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Fire-suppression piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

E. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.5 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames.

1.6 INTENT OF CONTRACT DOCUMENTS

A. Fire Suppression/Protection drawings are diagrammatic, indicating general locations and arrangements of pipe, and equipment. Not necessarily indicating all offsets, conditions, and appurtenances required to provide clearances for maximum practical accessibility to perform maintenance.

B. Coordinate work to achieve proper operation and to provide a maintainable installed condition.

C. Notify the Architect's representative immediately of conditions which do not comply or will not produce this result.

PART 2 - PRODUCTS

2.1 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match fire-suppression piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180ºF.

D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and non-corrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225ºF.

F. Dielectric Nipples: Electroplated steel nipple with inert and non-corrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225ºF.]

2.2 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 JOINING MATERIALS

A. Pipe Joint Compound for Threaded Pipe: UL listed.

2.4 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.5 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around fire-suppression piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw. Finish: Polished chrome-plated and rough brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw. Finish: Polished chrome-plated and rough brass.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 FIRE-SUPPRESSION PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install fire-suppression piping according to the following requirements and Division 21 Sections specifying fire-suppression piping systems.

B. Install fire-suppression piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install fire-suppression piping indicated to be exposed and fire-suppression piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise. Diagonal runs are permitted in the attic spaces.

D. Install fire-suppression piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install fire-suppression piping to permit valve servicing.

F. Install fire-suppression piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Fire-suppression piping:

a. Fire-suppression piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Fire-suppression piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Fire-suppression piping: One-piece, stamped-steel type with spring clips.
d. Bare Fire-suppression piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Fire-suppression piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
f. Bare Fire-suppression piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
g. Bare Fire-suppression piping in Equipment Rooms: One-piece, cast-brass type.
h. Bare Fire-suppression piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

J. Sleeves are not required for core-drilled holes through solid concrete walls and floors.

K. Sleeves are required in all interior partitions.

L. Permanent sleeves are not required for holes formed by removable PE sleeves.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

3. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 FIRE-SUPPRESSION PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying fire-suppression piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or pipe joint compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Grooved Joints: Assemble joints with listed coupling, gasket, lubricant, and bolts.

1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
2. Steel Pipe: Roll-groove piping. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.

F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Fire-suppression piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Fire-suppression piping: Join according to ASTM D 2846/D 2846M Appendix.

I. Plastic Pressure Fire-suppression piping Gasketed Joints: Join according to ASTM D 3139.

3.3 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.5 GROUTING

A. Mix and install grout for fire suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.6 EXCAVATION AND BACKFILL

A. Excavation and backfill shall be as indicated in Division 1 specifications and on the drawings. If excavation and backfill is not otherwise indicated the following shall apply:
1. Excavate trenches to indicated gradients, lines, depths, and elevations.

a. Beyond the building perimeter, excavate trenches to allow installation of top of pipe below minimum depth of cover based on locality or 1'-0" below frost line whichever is lower.

2. Excavate trenches to uniform widths to provide twelve inches clear on each side of pipe. Excavate trench walls vertically from trench bottom.
3. Trench Bottoms: Excavate trench bottoms to provide flat surface. Place and compact six inches of sand. Excavate and shape sand to provide uniform bearing and support of pipes. Shape sand to provide continuous support for bells, joints, fittings, and barrels of pipes. Sand shall be free of projecting stones and sharp objects.
4. Backfill and hand tamp to 95% proctor to six inches above the top of the pipe.
5. Backfill and machine tamp the remainder of the trench to 95% proctor in twelve-inch lifts.

END OF SECTION 210500

-- THIS PAGE INTENTIONALLY LEFT BLANK --

SECTION 211000 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUMMARY

A. Description of Work:

1. The work includes designing and providing an automatic fire extinguishing system of required hazard for building occupancy to afford complete fire protection coverage throughout. Where required the work shall include complete standpipe systems The design, equipment, materials, installation and workmanship shall be in strict accordance with the Owners insurance underwriters requirements, the Virginia Construction Code, and the required and advisory provisions of NFPA.

2. Unless otherwise indicated piping shall not be run in spaces containing electrical equipment in the form of transformers, panel-boards, switchgear, or computer servers.
   a. Exceptions:
      1) Personal computers (PCs)
      2) Spaces whose name does not include the term "Electrical", "Data", or "Computer."

3. Each system shall include materials, accessories and equipment necessary to provide each system complete and ready for use.

4. The design of each system shall give full consideration to blind spaces, piping, electrical equipment, ductwork, and all other construction and equipment to afford complete coverage.

5. Devices and equipment for fire protection service shall be of an approved make and type listed by the Underwriters' Laboratories, Inc., or approved by the Factory Mutual System.

6. In the publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears.

7. Reference to the "authority having jurisdiction" shall be interpreted to mean the Local Fire Marshal.

8. Calculations shall include delivering water from the point of the fire hydrant flow test through the site piping.

9. Consideration shall be given to all unheated areas such as attics, utility rooms, loading docks, outdoor storage spaces with canopies, etc., to provide freeze protection in accordance with NFPA 13. This shall include the installation of dry sprinklers, anti-freeze, and dry-pipe sprinkler systems where necessary.

1.3 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

B. Preaction Sprinkler System: Automatic sprinklers are attached to piping containing air. Actuation of fire-detection system in same area as sprinklers opens deluge valve, permitting water to flow into piping and to discharge from sprinklers that have opened.

1.4 PERFORMANCE REQUIREMENTS

A. Component Working Pressure: Listed for at least 175 psig.

B. Design shall be approved by authorities having jurisdiction.

C. Fire-suppression sprinkler system design shall include the following:

1. Margin of Safety for Available Water Flow and Pressure: As required by local Fire Marshal's Office, 10 psi or 10% of system pressure required. Whichever is greater.
2. Sprinkler Occupancy Hazard Classifications shall be as indicated on the drawings. If not indicated comply with NFPA 13.
3. Maximum Protection Area per Sprinkler shall be in accordance with its UL listing.

D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to ASCE 7-02, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

E. Seismic Performance for category C thru F: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13

1.5 SUBMITTALS

A. Product Data: For the following:

1. Piping materials, including flexible connections, and sprinkler specialty fittings.
2. Pipe hangers and supports.
3. Valves, including listed fire-protection valves, unlisted general-duty valves, specialty valves and trim.
4. Air compressors, including electrical data.
5. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.

6. Hose connections, including size, type, and finish.
7. Hose stations, including size, type, and finish of hose connections; type and length of fire hoses; finish of fire hose couplings; type, material, and finish of nozzles; and finish of rack.
8. Alarm devices, including electrical data.

B. Fire-hydrant flow test report.

C. Approved Sprinkler Piping Shop Drawings: Working plans, prepared according to NFPA 13, including hydraulic calculations. Diagram power, signal, and control wiring.
1. Include shop drawings indicating location of all sprinkler heads and all other construction that penetrates ceilings, including light fixtures, HVAC equipment, speakers, fire alarm devices, partition assemblies, etc.

D. Welding certificates.

E. Operation and Maintenance Data to include in emergency, operation, and maintenance manuals.

1.6 CLOSEOUT SUBMITTALS

A. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. A Professional Engineer registered in the state where the project is constructed shall stamp and seal the Shop Drawings.

B. Flow test:

1. Bid shall be based on the indicated fire-hydrant flow and pressure.

2. Design calculations shall be based on the results of a confirming fire-hydrant flow test performed or caused to be performed by the contractor.

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

D. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13: "Installation of Sprinkler Systems." applicable edition.

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Coordination for exposed sprinkler piping:
   1. The intent for this coordination is to reduce the visibility of exposed sprinkler piping within exposed spaces. The shop drawings shall identity exposed areas to eliminate exposed sprinkler piping as much as possible.
   2. For clear stories: Coordinate Sprinkler piping to avoid piping be installed in front of glazing assemblies. Where routing shall be in between windows or in front of mullions for a neat exposed appearance approved by Architect.
   3. For roof height elevation changes in exposed areas: Limit Sprinkler piping to 1 or 2 locations within a single open space to reduce visibility of vertical piping. Sprinkler mains shall not be routed in exposed areas unless required. If required the main locations shall be coordinated with Architect.
   4. Where vertical exposed piping occurs the piping shall be installed along the wall and in the corner to reduce visibility.

1.9 SPRINKLER CABINET(S) AND SPARE SPRINKLERS

A. Provide finished, wall-mounted, steel sprinkler cabinet with hinged cover.

B. Provide space for minimum of six spare sprinklers and sprinkler wrench.

C. Provide minimum of six spare sprinklers and sprinkler wrench in cabinet.

D. Provide number of sprinklers required by NFPA 13.

E. Provide separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

F. Provide products packaged with protective covering for storage. Identify contents with label.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

   1. Mechanical-Joint, Ductile-Iron Fittings AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.

1. Push-on-Joint, Ductile-Iron Fittings AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory formed, radius-cut-grooved ends according to AWWA C606.

1. Grooved-Joint Piping Systems:

a. Manufacturers including but not limited to:

1) Victaulic Co. of America.

b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD.
c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts. Basis of Design: Victaulic Style 31.
d. Grooved-End-Pipe Transition Coupling: UL 213 and AWWA C606, gasketed fitting with end matching ductile-iron-pipe OD and end matching steel-pipe OD. Include ductile-iron housing with key matching ductile-iron-pipe groove and key matching steel-pipe groove, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts. Basis of Design: Victaulic Style 307.

2.2 STEEL PIPE AND FITTINGS

A. Threaded-End, Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or shop-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865.

B. Plain-End, Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized where indicated.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

C. Grooved-End, Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, square-cut- or roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal. .

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.

1. Installation-Ready fittings for grooved end steel piping in fire protection applications sizes NPS 1-¼ thru 2½ (DN 32 thru DN 65). Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready ends, orange enamel coated Fittings complete with prelubricated Grade "E" EPDM Type 'A' gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa).

2. Fittings shall have a shorter center-to-end dimensions for installation in tight spaces.

3. Fittings are rigid, for direct stab installation without field disassembly.

4. Fittings shall require visual pad-to-pad verification of complete installation.

c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and ASTM A449 compliant steel bolts and nuts. Coupling design shall be visual bolt pad to bolt pad, NO coupling requiring a torque wrench shall be used. For dry systems a Flush Seal gasket shall be used.

1) Mechanical Couplings:

a. Basis of Design: Subject to compliance with requirements, provide Victaulic or Engineered approved equal.
b. Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and A-183, minimum tensile strength 110,000 psi (758450 kPa)

1. Rigid Type:

a. Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13.
b. Rigid couplings shall require visual pad-to-pad verification of complete installation. Tongue and recess type couplings which require the use of a torque wrench to achieve the exact required gap between housings are not permitted.

2. Flexible Type: Use in seismic areas where required by NFPA 13.

a. "Installation Ready" flexible joints shall be Victaulic Style 177N QuickVic™, in sizes 2"(DN50) through 8"(DN200), which shall be

designed for direct "stab" installation onto grooved pipe without prior disassembly of the coupling. .

d. 2) Standard flexible couplings shall be Victaulic Style 77.

D. Grooved-End, Schedule 10 Steel Pipe: Schedule 10 in NPS 2-1/2 to NPS 5; and NFPA 13-specified wall thickness in NPS 6 to NPS 10; with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company: FireLock or engineer approved equal

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.

c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

d. In lieu of rigid pipe offsets or return bends for sprinkler drops, the Victaulic VicFlex™ Multiple-Use Flexible Stainless Steel Sprinkler Drop System may be used to locate sprinklers as required by final finished ceiling tiles and walls. The drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel Male threaded nipple or Victaulic FireLock IGS Groove Style 108 coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread for connection to the sprinkler head.

1) The drop shall include a UL approved Series AH1 with 3" bend radius; AH2 or AH2-CC braided hose with a bend radius to 2" to allow for proper installation in confined spaces.
2) Union joints shall be provided for ease of installation.

3) The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 or AB2 bracket. The bracket shall allow installation before the ceiling tile is in place.

2.3 FLEXIBLE CONNECTORS

A. Flexible connectors shall have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:

1. NPS 2 and Smaller: grooved.
2. NPS 2-1/2 (DN 65) and Larger: grooved.
3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

C. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.4 CORROSION-PROTECTIVE ENCASEMENT FOR PIPING

A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.5 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have

B. Outlet Specialty Fittings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal
2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and grooved outlets.
3. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded or grooved or grooved outlet.

C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded, grooved or locking-lug inlet and outlet, test valve, and orifice and sight glass.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

2.6 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

B. Ball Valves: Comply with UL 1091, except with ball instead of disc.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal.
2. NPS 1-1/2 and Smaller: Bronze or brass body with threaded or grooved ends. Basis of Design: Victaulic Series 728.
3. NPS 2 and NPS 2-1/2: Ductile-iron body with grooved ends.
4. NPS 3: Ductile-iron body with grooved ends.

C. OS&Y Gate Valves: UL 262.

1. Ductile-iron body with flanged x Groove or groove x groove ends. No Flange x Flange will be accepted.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal.

D. Butterfly Valves: UL 1091.

1. NPS 2 and Smaller: Bronze body with grooved ends.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends. Valve seat shall be pressure-responsive, and the stem offset from the disc centerline to provide complete 360-degree circumferential seating. Basis of Design: Victaulic Series 705. Each valve must be individually tested at factory to include electronics.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

E. Check Valves NPS 2 and Larger: UL 312, spring-assisted swing type for vertical or horizontal installation, cast- ductile iron body with flanged or grooved ends. Basis of Design: Victaulic Series 717.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Weatherproof actuator housing with electrical, 15 amp @125-VAC 60 HZ, prewired, single-pole-single-throw, supervisory switches
2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded or grooved or grooved ends. Basis of Design: Victaulic Series 728.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

G. Double Check Backflow Preventers:

1. Manufacturers including but not limited to:

a. Ames Co.
b. Conbraco.
c. Febco.
d. Apollo Valves - Apollo Valves - Conbraco Industries, Inc.
e. Watts Industries, Inc.; Water Products Div.
f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1015

3. Application: continuous-pressure.

4. Pressure Loss: 8 psig maximum, through middle 1/3 of flow range.

5. Size: ¾" thru 10" as required to match connected piping.

6. Body: Brass or bronze for NPS 2 and smaller; cast iron or steel with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.

7. Configuration: As needed for installation.

8. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of 2" and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of 2 ½" and larger.

2.7 GENERAL-DUTY VALVES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

B. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.

C. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.8 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

2. Riser Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for drain and pressure gages.

3. Floor control valve assemblies: Universal Manifold Check Valve | Model UMC

Model UMC - 1-1/4, 1-1/2, 2, 2-1/2, 3, 4, 6, and 8-inch Universal Manifold Check Valve: Where universal manifold check valves are specified for use in wet-pipe sprinkler systems, as floor control manifolds they shall be specifically listed for such use. Universal manifold check valves shall be ductile iron construction, incorporating a control valve, check valve, flow switch, test & drain assembly, adjustable relief valve, and system gauges in one compact body/footprint, and shall be manufactured for "right" and "left"-hand orientations. The test & drain assemble shall contain an adjustable relief valve, with a range of 175 to 310 psi, and a universal test orifice of K2.8; to provide testing capabilities of systems with k-factors ranging from K2.8 and larger. The Universal Manifold Check valve shall be rated for use at the maximum service pressure of 300 psi and shall be UL listed and FM approved. Universal manifold check valves shall be the Model UMC; as manufactured by Globe brand by Victaulic Company.

a. \

B. Preaction Valves and Deluge valves: Basis of design : Subject to compliance with requirements, provide Victaulic or Engineered equal. Valves must be inside an enclosure with climate control.

C. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Basis of design Victaulic/Globe.

D. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or engineer approved equal

E. Automatic Sprinklers: UL-Listed with quick response glass bulb type heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.

F. Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body.

G. Sprinkler types, features, and options as follows:

1. Brass upright sprinklers.
2. Extended-coverage sprinklers.
3. Concealed pendent sprinklers, including cover plate.
4. Pendent sprinklers.
5. Pendent, dry-type sprinklers.
6. Quick-response sprinklers.
7. Recessed sprinklers, including escutcheon.
8. Sidewall sprinklers.
9. Sidewall, dry-type sprinklers.
10. Attic sprinkler Globe Brand by Victaulic where applicable.
11. Grooved heads as manufactured by Victaulic.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: 2 piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: 2 piece, with 1-inch horizontal adjustment.

I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

J. In lieu of rigid connections to dry sprinkler heads, a Victaulic VicFlex™ dry sprinkler, Model VS1, may be used. The sprinkler shall provide a vertical or horizontal flexible connection with a bend radius to 2" and allow for up to 4 bends.

K. For cooler or Freezer boxes: Victaulic AB6 Freezer dry pendant utilizing a flexible hose connection shall be used. No dry Pendant utilizing a rubber boot will be allowed.

L. For Vestibules: Install Dry type horizontal sidewall sprinklers.

2.9 FIRE DEPARTMENT CONNECTIONS

A. Manufacturers:

1. Central Sprinkler Corp.
2. Elkhart Brass Mfg. Co., Inc.
3. Fire-End and Croker Corp.
4. Guardian Fire Equipment Incorporated.
5. Potter-Roemer; Fire-Protection Div.

B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."

1. Type: Flush, with two inlets and square or rectangular escutcheon plate.
2. Finish: Chrome plated.

2.10 TEST HEADER FOR BACKFLOW PREVENTER

A. Manufacturers:

1. Elkhart Brass Mfg. Co., Inc.
2. Fire-End and Croker Corp.
3. Guardian Fire Equipment Incorporated.
4. Potter-Roemer; Fire-Protection Div

B. Hose Valve Manifold Assembly:

1. Header Pipe: Schedule 40, steel or ductile iron.
2. Header Pipe Fittings: galvanized cast-iron threaded fittings.
3. Automatic Drain Valve: UL 1726
4. Hose Valves: UL 668, straightway pattern, chrome plated with cap and chain. Include NFPA 1963 hose thread that complies with local fire department standards and finish same as for test-header-manifold escutcheon plate.

5. Nipples: Schedule 40 galvanized-steel pipe with threaded ends.
6. Caps with Chain: Chrome plated with threaded outlet.
7. Escutcheon Plate: Chrome plated, rectangular.
8. Exposed Parts Finish: Chrome plated.
9. Escutcheon Plate Marking: "BKFL TEST CONN"

2.11 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Wet Pipe Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

1. Available Manufacturers:

a. Grinnell Fire Protection.
b. ITT McDonnell & Miller.
c. Potter Electric Signal Company.
d. Viking Corp.
e. Watts Industries, Inc.; Water Products Div.

C. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Available Manufacturers:

a. McWane, Inc.; Kennedy Valve Div.
b. Potter Electric Signal Company.
c. System Sensor.

D. Indicator-Post Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

1. Available Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

F. Outside Electric Bell: UL 753, 120VAC with weatherproof backbox.

1. Available Manufacturers:

a. Notifier
b. Potter Electric Signal Company.
c. System Sensor.

2.12 PRESSURE GAGES

A. Available Manufacturers:
1. Dresser Equipment Group; Instrument Div.

B. Description: UL 393, 3-1/2" to 4-1/2" diameter dial.

C. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA standards, procedures, appendices, or recommendations.

B. Report test results no later than two days following the test in writing.

3.2 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.3 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS, GENERAL

A. Provide shop-welded joints where welding is required.

B. Provide shop or manufacturer-threaded or grooved joints where threads are required.

C. Field-welded joints will be permitted where indicated on the drawings. Field welding is optional where indicated. Other approved or specified methods are acceptable.

D. Do not use welded joints for galvanized-steel.

E. Flanges, flanged fittings, unions, nipples, transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

F. Underground Piping: Ductile-iron, mechanical-joint pipe and fittings with restrained joints. Include corrosion-protective encasement**.**

3.5 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:

1. Sprinkler Piping NPS 2" and smaller use any of the following:
    a. Threaded or grooved-end, black, schedule 40 steel pipe; cast- or malleable-iron threaded or grooved fittings; and threaded or grooved joints.
    b. Plain-end, black, schedule 40 steel pipe; steel welding fittings; and welded joints.
    c. Grooved-end, black, schedule 40 steel pipe with square-cut- or roll-grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
2. Sprinkler Piping NPS 2 ½" and larger use any of the following:
    a. Threaded or grooved-end, black, schedule 40 steel pipe; cast- or malleable-iron threaded or grooved fittings; and threaded or grooved joints.
    b. Plain-end, black, schedule 10 steel pipe; steel welding fittings; and welded joints.
    c. Grooved-end, black, Schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and roll grooved joints.

3.6 VALVE APPLICATIONS

A. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for application.
    a. Shutoff Duty: Use ball, or butterfly valves.

3.7 JOINT CONSTRUCTION

A. Refer to Section "Common Work Results for Fire Suppression" for basic piping joint construction.

B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than 8" with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction.

C. Threads shall be checked by a ring gage and shall comply with ASME B1.20.1.

D. Grooved Joints: Assemble joints with listed coupling, gasket, lubricant, and bolts.

1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
2. Steel Pipe: Roll-groove piping. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.

3. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
4. NPS 2-1/2 to NPS 4: Use dielectric flanges.
5. NPS 5 and Larger: Use dielectric flange insulation kits.**]**

3.8 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.9 PIPING INSTALLATION

A. Refer to Section "Common Work Results for Fire Suppression" for basic piping installation.

B. Locations and Arrangements: Drawing plans, shop drawings, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated.

1. Deviations from approved working drawings for piping require written approval from authorities having jurisdiction and Architect. File written approval with Architect before deviating.

C. Install underground piping according to NFPA 13, NFPA 24 and Drawings. Provide restrained joints. Provide corrosion-protective encasement.

D. Provide approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Provide unions adjacent to each valve in pipes 2" and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

F. Provide flanges or flange adapters on valves, and equipment having 2-1/2" and larger pipe connections.

G. Provide "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve. Test connections that discharge to the exterior shall discharge 1'-0" above a concrete splash block. Provide splash block under this section of the specifications. Pipe penetration shall be installed to coursing dimensions where concrete masonry units are utilized to construct wall.

H. Provide sprinkler piping with drains for complete system drainage.

I. Provide alarm devices.

J. Hangers and Supports: Refer to Section "Hangers and Supports for Fire-Suppression Piping" for hanger materials.
1. Install sprinkler system piping according to NFPA 13.

K. Earthquake Protection for Seismic Design Category C thru F: Install piping according to NFPA 13 to protect from earthquake damage.

L. Install pressure gages on each riser or feed main, and at each sprinkler test connection. Include pressure gages with connection not less than ¼" and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where not subject to freezing.

M. Pressurize and check preaction sprinkler system piping and air compressors.

N. Fill wet-pipe sprinkler system piping with water.

3.10 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Valves for Wall-Type Fire Hydrants: Install nonrising-stem gate valve in water-supply pipe.

D. Install backflow preventer in potable-water supply sources.

E. Specialty Valves:

1. Riser Check Valves: Install in vertical position for proper direction of flow.
2. Deluge Valves: Install in vertical position, in proper direction of flow, in main supply to preaction system.
3. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

    a. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.
    b. Install air compressor and compressed-air supply piping.

3.11 SPRINKLER APPLICATIONS

A. Use the following sprinkler types unless otherwise indicated:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Recessed pendent sprinklers.
3. Wall Mounting: Recessed Sidewall sprinklers.
4. Spaces Subject to Freezing: Dry pendent sprinklers.
5. Special Applications: Extended-coverage, and quick-response sprinklers where required.

6. Sprinkler Finishes:

   a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough brass in unfinished spaces not exposed to view.
   b. Concealed Sprinklers: Rough brass, with factory white painted cover plate.
   c. Recessed Sprinklers: Chrome plated with matching two-piece escutcheon.

3.12 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in the center of acoustical ceiling panels and tiles.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space wherever possible. Otherwise, use antifreeze sprinkler systems, or dry-pipe systems.

3.13 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

B. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping.

C. Install ball drip valves at each check valve for fire department connection. Drain as indicated. If not indicated otherwise, drain to floor drain or outside building.

D. Connect air compressor to the following piping and wiring:

   1. Pressure gages and controls.
   2. Electrical power system.
   3. Fire alarm devices, including low-pressure alarm.

E. Coordinate connection of alarm devices to fire alarm.

F. Ground equipment. Grounding shall be in accordance with section "Grounding and Bonding for Electrical Systems."

G. Coordinate connection of wiring.

H. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.14 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and section "Common Work Results for Fire-Suppression" for piping identifications.

3.15 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Energize circuits to electrical equipment and devices.
4. Start and run air compressors.
5. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
6. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
7. Coordinate with fire alarm tests. Operate as required.
8. Coordinate with fire-pump tests. Operate as required.
9. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.16 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Provide sprinklers to replace sprinklers with paint or coating other than the original factory finish.

C. Protect sprinklers from damage and debris until Substantial Completion.

D. Protect the building exterior when operating drains and test connections discharging to the building exterior.

E. Dirt and stains on any surfaces resulting from the work of this section shall be cleaned and removed under this section.

3.17 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the system.

END OF SECTION 211000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.

4. Escutcheons.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.7 INTENT OF CONTRACT DOCUMENTS

A. Plumbing drawings are diagrammatic, indicating general locations and arrangements of pipe, and equipment. Not necessarily indicating all offsets, conditions, and appurtenances required to provide clearances for maximum practical accessibility to perform maintenance.

B. Coordinate work in order to achieve proper operation and to provide a maintainable installed condition.

C. Notify the Architect's representative immediately of conditions which do not comply or will not produce this result.

D. Indicated configurations were used to size pipes, pumps, expansion tanks and other devices. Install piping and equipment generally as indicated. Minor deviations are permitted in the course of necessary coordination. Major changes shall be submitted for approval by the Architect's representative. Additional fittings and offsets not shown on the drawings are expected, anticipated by the design, and shall be provided. If more than 5% of the indicated number of fittings are required or if one change in direction is within six inches of another change in direction and this "Z" shape is not indicated notify the Architect's representative immediately. Provide necessary additional fittings and offsets. Changes in pipe size shall be made only with written approval from the Architect's representative.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to other Division 22 piping sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 22 piping sections for joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions inside & outside pipe and:

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is otherwise indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8-inch-thick, unless otherwise indicated, and full-face or ring type, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free (95% Tin, 5% Antimony) alloy. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

2.3 MECHANICAL GROOVED JOINT COUPLINGS

A. Manufacturer: Victaulic

B. Description: Pipe joint consisting of a grooved pipe, EPDM gasket, steel housing, 2 bolts and 2 nuts.

C. Gasket Material: Grade "E" EPDM suitable for use up to 250 degrees F.

D. Housing: Carbon steel

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig working pressure, as required to suit system pressures.

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PE: Reusable, PE, tapered-cup-shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 2 Sections "Site and Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Remove equipment and associated piping back to main unless otherwise indicated. Cap services.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services. Remove, clean, and store equipment. When appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Remove equipment and associated piping back to main unless otherwise indicated. Cap services. Remove equipment, clean, and store as directed (May be off-site). Make available to owner at time of the owner's choosing.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following and Division 22 Sections specifying piping systems.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at the minimum slopes required by authorities having jurisdiction unless otherwise indicated.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Exposed, Interior Installations/Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
2. Exposed, Interior Installations/Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish and set-screw.
3. Exposed, Interior Installations/Insulated Piping: One-piece, cast-brass type with polished chrome-plated finish.
4. Exposed, Interior Installations/Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with finish to match surrounding surfaces.
5. Exposed, Interior Installations/Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with finish to match surrounding surfaces.
6. Exposed, Interior Installations/Piping in Unfinished Service Spaces: None, provide sealant.
7. Exposed, Interior Installations/Piping in Equipment Rooms: None, provide sealant.
8. Exposed, Interior Installations/Piping at Floor Penetrations in Equipment Rooms, Fan Rooms, or similar wet spaces: None - provide sealant and sleeve extending 2" above floor to prevent liquid leaking to floor below

L. Sleeves are not required for core-drilled holes.
1. Exception: Exposed, Interior Installations at Floor Penetrations in Equipment Rooms, Fan Rooms, or similar wet spaces.

M. Permanent sleeves are not required for holes formed by removable PE sleeves.
1. Exception: Exposed, Interior Installations at Floor Penetrations in Equipment Rooms, Fan Rooms, or similar wet spaces.

N. Install sleeves for pipes passing through walls, floors, or roofs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring.

2. Install sleeves as walls and slabs are constructed.

    a. PVC Pipe Sleeves: Permitted for pipes smaller than NPS 6 except aboveground, exterior-walls.
    b. Steel Sheet Sleeves: Permitted for pipes NPS 6 and larger, penetrating gypsum-board partitions except aboveground, exterior-walls.

    c. Stack Sleeve Fittings: For pipes penetrating floors. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor. Seal space outside sleeve fittings with grout.

3. Except for penetrations where mechanical sleeve seals are used, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants".

O. Aboveground Exterior Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for annular clear space required by the mechanical sleeve seal manufacturer between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
4. Sleeves from an approved sleeve seal manufacturer shall be acceptable.

P. Underground Exterior Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for annular clear space required by the mechanical sleeve seal manufacturer between pipe and sleeve for installing mechanical sleeve seals.

Q. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Section "Penetration Firestopping" for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Non-pressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Non-pressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

N. Mechanical Joints: Prepare pipe ends and fittings, apply coupling, and join according to joint manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2" and smaller, one adjacent to each valve and at final connections to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2" and larger, adjacent to final connections to each piece of equipment.
3. Install dielectric unions or flanges for connections of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 HOUSEKEEPING PADS AND EQUIPMENT PADS

A. Housekeeping pads and equipment pads: Anchor equipment to concrete according to equipment manufacturer's written instructions and according to seismic codes at project location.

1. Construct concrete pads in accordance with drawing details.
2. Details may be found on structural drawings. If details are not provided comply with the following:
    a. Housekeeping pads inside the building shall be 4" thick and 6" larger all around than supported equipment. Provide a 1" chamfer on all edges.
    b. If details are not provided, equipment pads outside the building shall be 8" thick with a 24" deep 12" wide turndown (footing) all around the outside edge of the pad. Provide welded wire mesh reinforcement. Pad shall be 12" larger all around than supported equipment.
    c. Install dowel rods to connect housekeeping pad to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the pad. Provide a 1" chamfer on all edges.
    d. Install epoxy-coated anchor bolts. For equipment on housekeeping pads bolts shall extend through housekeeping pad, and anchor into structural concrete floor.
    e. Place and secure anchor bolts using supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions for placement.
    f. Install anchor bolts to elevations required for proper attachment to supported equipment.
    g. Install anchor bolts according to anchor bolt manufacturer's written instructions.
    h. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section "Cast-in-Place Concrete".

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.10 EXCAVATION AND BACKFILL

A. Excavation and backfill shall be as indicated in Division 1 specifications and on the drawings. If excavation and backfill is not otherwise indicated the following shall apply:
   1. Excavate trenches to indicated gradients, lines, depths, and elevations.
      a. Beyond the building perimeter, excavate trenches to allow installation of top of pipe below frost line.
   2. Excavate trenches to uniform widths to provide twelve inches clear on each side of pipe. Excavate trench walls vertically from trench bottom.
   3. Trench Bottoms: Excavate trench bottoms to provide flat surface. Place and compact six inches of sand. Excavate and shape sand to provide uniform bearing and support of pipes. Shape sand to provide continuous support for bells, joints, fittings, and barrels of pipes. Sand shall be free of projecting stones and sharp objects.
   4. Backfill and hand tamp to 95% proctor to six inches above the top of the pipe.
   5. Backfill and machine tamp the remainder of the trench to 95% proctor in twelve inch lifts.

END OF SECTION 220500

SECTION 220513 – MOTORS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Manufacturer's catalog and efficiency data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.4 COORDINATION

A. Equip all motors with overload protection.

1. Locate overload protection near the motor.
2. Overload protection:
    a. Locate between the circuit breaker/fuse provided under Division 26 and the motor windings.
    b. Comply with one of the following:
        1) Locate in motor by motor manufacturer. (Design Standard)
        2) Locate separate overload device near motor.
        3) Locate in, or with, disconnect switch by equipment manufacturer. Provision of such switch shall not modify, change, or eliminate Division 26 requirements. Provide indicated disconnecting means.

B. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:

C. Compatible with controller.

D. Matched to torque and horsepower requirements of the load.

E. Matched to ratings and characteristics of supply circuit and required control sequence.

F. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

G. Belt tension must be wrench and socket adjustable.

H. Belt tensioning device must accommodate adjustable sheaves.

PART 2 - PRODUCTS

2.1 MOTOR REQUIREMENTS

A. Motor requirements apply except as follows:

B. Ratings, performance, or characteristics for a motor are specified in another Section or are scheduled on the drawings.

C. Motor manufacturer requires ratings, performance, or characteristics, other than those specified to meet indicated performance.

2.2 MOTOR CHARACTERISTICS

A. Frequency Rating: 60 Hz.

B. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

C. Duty: Continuous at 105 deg F and 3300 feet above sea level.

D. Capacity and Torque sufficient to:

1. Start, accelerate, and operate connected load.
2. Maintain designated speeds.
3. Operate at installed altitude and environment.
4. Operate with indicated operating sequence.
5. Operate without exceeding nameplate ratings.
6. Operate without utilizing service factor.

E. Enclosure: Open drip-proof unless otherwise indicated.

F. Minimum Service Factor: 1.15 unless otherwise indicated.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Premium efficiency motors shall meet the following full load efficiency:

HP	ODP			TEFC		
	6 Pole	4 Pole	2 Pole	6 Pole	4 Pole	2 Pole
1	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2	87.5	86.5	85.5	88.5	86.5	85.5
3	88.5	89.5	85.5	89.5	89.5	86.5
5	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1
125	95.0	95.4	94.1	95.0	95.4	95.0
150	95.4	95.8	94.1	95.8	95.8	95.0

C. Efficiency: Premium

D. Stator: Copper windings, unless otherwise indicated.

E. Rotor: Squirrel cage, unless otherwise indicated.

F. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating, unless otherwise indicated.

H. Insulation: Class F, unless otherwise indicated.

I. Code Letter Designation: NEMA starting Code F or G.

J. Enclosure: Cast iron.

K. Finish: Gray enamel.

L. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

M. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:

N. Measure winding resistance.

O. Read no-load current and speed at rated voltage and frequency.

P. Measure locked rotor current at rated frequency.

Q. Perform high-potential test.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Perform the following:

1. Run each motor with its controller at load.
2. Demonstrate correct rotation, alignment, and speed.
3. Test interlocks and control features for proper operation.
4. Verify that current in each phase is within nameplate rating.
5. Verify RPM is in accordance with nameplate.
6. Where a generator is provided, run each motor on the generator with its controller and load. Demonstrate correct rotation, alignment, and speed.

3.2 ADJUSTING

A. Align motors, bases, and shafts.

3.3 CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

END OF SECTION 220513

SECTION 220516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Maintenance Data: For expansion joints to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PACKLESS EXPANSION JOINTS

A. Flexible-Hose Packless Expansion Joints:

1. Available Manufacturers:

a. Flex-Hose Co., Inc.
b. Flexicraft Industries.
c. Flex Pression Ltd.
d. Metraflex, Inc.
e. Unisource Manufacturing, Inc.

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.

3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.

    a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
    b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.

5. Expansion Joints for Copper Tubing 2-1/2" to 4": Copper-alloy fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.

2.2 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Available Manufacturers:

    a. Adsco Manufacturing LLC.
    b. Advanced Thermal Systems, Inc.
    c. Flex-Hose Co., Inc.
    d. Flexicraft Industries.
    e. Flex-Weld, Inc.
    f. Hyspan Precision Products, Inc.
    g. Metraflex, Inc.
    h. Unisource Manufacturing, Inc.

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Stud: Threaded, zinc-coated carbon steel.
    b. Expansion Plug: Zinc-coated steel.
    c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
    b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
    c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

C. Install rubber packless expansion joints according to FSA-NMEJ-702.

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Connect risers and branch connections to mains with a minimum of 5 (five) pipe fittings including tee in main.

B. Connect risers and branch connections to terminal units with a minimum of 4 (four) pipe fittings including tee in riser.

C. Connect mains and branch connections to terminal units with a minimum of 4 (four) pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four Insert number pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 220516

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Link Seal
   d. Metraflex Co.
   e. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide ¼" clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants.

E. Fire Ratings: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building unless otherwise indicated. They are not required at sanitary and storm piping exits unless otherwise indicated.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade, below Grade, Concrete Slabs-on-Grade, and Concrete Slabs above Grade:

a. Piping Smaller Than 6": Cast-iron wall sleeves with sleeve-seal system.
1) Select sleeve size to allow for one inch (1") annular clear space between piping and sleeve for installing sleeve-seal system.
b. Piping 6" and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.

END OF SECTION 220517

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

1.3 ABBREVIATIONS:

A. AFF Above finished floor
B. F Fahrenheit
C. SS Stainless Steel

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Available Manufacturers:

    a. Flo Fab Inc.
    b. Miljoco Corporation.
    c. Palmer Wahl Instrumentation Group.
    d. Tel-Tru Manufacturing Company.
    e. Trerice, H. O. Co.
    f. Weiss Instruments, Inc.
    g. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in degrees F.

7. Window: Glass
8. Stem: Aluminum length = 1/2 pipe diameter, 1/2 duct width or 12" whichever is less.

    a. Air-Duct Installation: Provide ventilated shroud.
    b. Thermowell Installation: Provide Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into threaded fitting.
3. Material: Brass.
4. Type: Stepped shank unless straight or tapered shank is indicated.
5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
6. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length required to match thermometer bulb or stem.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Available Manufacturers:

    a. AMETEK, Inc.; U.S. Gauge.
    b. Ashcroft Inc.
    c. Ernst Flow Industries.
    d. Flo Fab Inc.
    e. Marsh Bellofram.
    f. Miljoco Corporation.
    g. Noshok.
    h. Palmer Wahl Instrumentation Group.
    i. REOTEMP Instrument Corporation.
    j. Tel-Tru Manufacturing Company.
    k. Trerice, H. O. Co.
    l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    m. Weiss Instruments, Inc.
    n. WIKA Instrument Corporation - USA.
    o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Solid-front, pressure relief type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Phosphor bronze.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Brass.
11. Accuracy: + or – 1.0 percent of full scale.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 pipe threads.

C. Valves: Brass or stainless-steel needle, with NPS 1/4, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings to match sizes.

C. Install thermowells with extensions on insulated piping.

D. Install direct-mounted thermometers in thermowells and adjust positions.

E. Install pressure gages in piping tees located between 36" and 60" above finished floor unless otherwise indicated.

F. Install valve and snubber for each pressure gage.

G. Install test plugs in piping tees at locations indicated.

H. Install permanent indicators on walls or brackets at 50" above finished floor unless otherwise indicated..

I. Install connection fittings in accessible locations for attachment to portable indicators.

J. Install thermometers in the following locations:
   1. Inlet and outlet of each water heater.

K. Install pressure gages in the following locations:
   1. Inlet and outlet of each water heater.
   2. Suction and discharge of each pump.

L. Install a test plug at each thermometer and pressure gauge.

3.2 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-water Piping: 0 to 100 F with 2 degree scale divisions.

B. Scale Range for Domestic Hot-water Piping 30 to 240 F with 2 degree scale divisions.

3.3 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Water Piping: 0 psi to 100 psi.

END OF SECTION 220519

SECTION 220523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. The following are standard abbreviations for valves:
1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. MPTFE: Modified polytetrafluoroethylene plastic.
4. NBR: Acrylonitrile-butadiene rubber.
5. PTFE: Polytetrafluoroethylene plastic.
6. RPTFE: Reinforced polytetrafluoroethylene plastic.
7. SWP: Steam working pressure.
8. TFE: Tetrafluoroethylene plastic.
9. WOG: Water Oil Gas.

1.3 SUBMITTALS

A. Product Data: For each type of valve proposed. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include proposed specialties and accessories.

1.4 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
1. Exceptions: Domestic hot- and cold-water valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.
4. Set butterfly valves closed or slightly open.

5. Block check valves in either closed or open position.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze & Brass: Shall be dezincification resistant. (Zinc content shall be less than 15%)

C. Bronze Valves: 2" and smaller with threaded ends, unless otherwise indicated.

D. Ferrous Valves: 2-1/2" and larger with flanged ends, unless otherwise indicated.

E. Valve Pressure and Temperature Ratings: Not less than indicated for system pressure and temperature.

F. Valve Sizes: Same as the larger of the upstream or downstream pipe, unless otherwise indicated.

G. Valve Actuators:
   1. As indicated in other Part 2 articles.
   2. Where indicated, provide a chain actuator.
   3. Chain Actuator: For attachment to valves of size and mounting height indicated.
   4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

H. Extended Valve Stems: Provide on insulated valves.

I. Valve Flanges: Provide ASME B16.1 for cast-iron valves, ASME B16.5 for steel, and ASME B16.24 for bronze.

J. Valve Grooved Ends: AWWA C606.

K. Threaded: With threads according to ASME B1.20.1.

L. Valve Bypass and Drain Connections: MSS SP-45.

2.2 COPPER-ALLOY BALL VALVES

A. Two-Piece, Copper-Alloy Ball Valves (Full Port):
1. Conbraco Industries-Apollo 77C series with stainless steel ball & stem (Un-insulated piping)
2. Conbraco Industries-Apollo 77C series with stainless steel ball & stem. Provide 2 ¼" stem extension (Insulated piping)
3. Other Manufacturers:
   a. Milwaukee
   b. Watts
   c. Nibco
4. Handle Nut: Zinc plated steel or 300 series stainless steel.
5. Handle: Zinc plated steel, clear chromate plastic, or vinyl coated.
6. Threaded Pack Gland: Brass ASTM B-16
7. Packing: MPTFE or TFE
8. Stem (Blowout Proof): ASTM A-276 type 316 stainless steel. Provide 2 ¼" stem extension for Insulated piping.
9. Thrust Washer: MPTFE or RPTFE
10. Ball: Full-port, ASTM A-276 Type 316 stainless steel.
11. Seats: MPTFE or Reinforced TFE (RPTFE)
12. Body: Bronze ASTM B-584 for solder or threaded connection.
13. Body End Piece: Bronze ASTM B-584 for solder or threaded connection.
14. Rating: 150 psig saturated steam, 600 psig non-shock cold water, oil, and gas.
15. Conform To: MSS SP-110

B. Two-Piece, Bronze Ball Valves UL listed for shut-off gas service (Up to2 ½"):
1. Conbraco Industries-Apollo 80-100 series (Un-insulated piping).
2. Conbraco Industries-Apollo 80-100 series with stainless steel ball & stem. Provide 2 ¼" stem extension (Insulated piping)
3. Other Manufacturers:
   a. Milwaukee
   b. Watts
   c. Nibco
4. Handle Nut: Zinc plated steel or 300 series stainless steel.
5. Handle: Zinc plated steel, clear chromate plastic, or vinyl coated.
6. Threaded Pack Gland: Brass ASTM B-16
7. Packing: MPTFE or TFE
8. Stem (Blowout Proof): ASTM A-276 type 316 stainless steel. Provide 2 ¼" stem extension for Insulated piping.
9. Thrust Washer: MPTFE or RPTFE
10. Ball: Brass ASTM B-16, chrome plated.
11. Seats: MPTFE or Reinforced TFE (RPTFE)
12. Body: Bronze ASTM B-584 for threaded connection.
13. Body End Piece: Bronze ASTM B-584 for threaded connection.
14. Rating: 150 psig saturated steam, 250 psi gas, vacuum service to 29".
15. Conform To: MSS SP-110

C. Two-Piece, Copper-Alloy Ball Valves (Full Port):Conbraco Industries - Apollo 77C-140 series with stainless steel ball & stem (Un-insulated piping)

2. Conbraco Industries - Apollo 77 C-140 series with stainless steel ball & stem. Provide 2 ¼" stem extension (Insulated piping)
3. Other Manufacturers:
   a. Milwaukee
   b. Watts
   c. Nibco.
4. Handle Nut: Zinc plated steel or 300 series stainless steel.
5. Handle: Zinc plated steel, clear chromate plastic, or vinyl coated.
6. Threaded Pack Gland: Brass ASTM B-16 Alloy 360
7. Packing: RPTFE or TFE
8. Stem (Blowout Proof): ASTM A-276 type 316 stainless steel. Provide 2 ¼" stem extension for Insulated piping.
9. Thrust Washer: MPTFE or Reinforced TFE
10. Ball: Full-port, ASTM A-276 Type 316 stainless steel.
11. Seats: MPTFE or Reinforced TFE
12. Body: Bronze ASTM B-584 for solder or threaded connection.
13. Body End Piece: Bronze ASTM B-584 for solder or threaded connection.
14. Rating: 150 psig saturated steam, 600 psig non-shock cold water, oil, and gas.
15. Conform To: MSS SP-110

2.3 MOTORIZED BALL VALVES

A. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ASCO Power Technologies, LP; Division of Emerson. Model 8210
   b. Magnatrol Valve Corporation.
   c. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
   d. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.4 LARGE GAS BALL VALVES (ABOVE 2 ½" to 10"):

A. Carbon Steel ANSI class 150, flanged, standard port ball valve with stainless steel ball and stem.
   1. Conbraco Industries-Apollo 88A-140 series
   2. Other Manufacturers:

a. Milwaukee
b. Watts
c. Nibco

3. Provide gear operator with oversized hand wheel.
4. Packing Gland: ASTM A108 Type 1215
5. Packing: RPTFE or TFE
6. Stem (Blowout Proof): ASTM A108 Type 1215
7. Ball: Standard-port, ASTM A-276 Type 316 stainless steel solid ball.
8. Seats: RPTFE
9. Thrust Washer: RPTFE.
10. Body: Carbon steel ASTM A216 WCB.
11. Body Nut: ASTM A194, grade 2H.
12. UL (YRPV): Listed for gas shut-off service.
13. Rating: 150 psig saturated steam

2.5 FERROUS-ALLOY BUTTERFLY VALVES

A. General: Butterfly valves shall provide bi-directional bubble tight dead end service without a downstream flange.

B. Wafer-lug type butterfly valves:
1. Conbraco Industries-Apollo 141(wafer)/143(lug)
2. Other Manufacturers:
a. Stockham
b. Demco
c. Nibco
3. Shaft: ASTM A-582 Type 416 Stainless steel single piece through shaft.
4. Collar Bushing: ASTM B-124 Brass or PTFE.
5. Stem Seal: EPDM OR Buna-N Rubber
6. Body Seal: EPDM Rubber
7. Upper Bushing: CDA 122 Copper or PTFE
8. Liner: EPDM Rubber
9. Disc: ASTM B-148 alloy 954/955 aluminum bronze.
10. Lower Bushing: CDA 122 copper or PTFE.
11. Body Wafer: ASTM A-536 Ductile Iron or ASTM A-126 CL. B cast iron.
12. Body Lug: ASTM A-536 Ductile Iron or ASTM A-126 CL. B cast iron.
13. Ratings:
a. 2" through 12" 200 psig CWP.
b. 14" through 24" 150 psig CWP.
14. Conform To: MSS SP-67, MSS SP-25, API-609
15. Operator:
a. Valves up to and including 6": Lever-lock operator.
b. Valves 8" and larger: Self locking worm gear operator equipped with adjustable stops at open and shut positions.

C. Grooved-End 300 psig butterfly valves:
1. NIBCO Model GD 4765
2. Other Manufacturers:
a. Victaulic

3. Upper Stem: ASTM A-582 Type 416 Stainless steel.
4. Upper Bearing: Split metal.
5. O-Ring: EPDM
6. Body: ASTM A-395 ductile iron with polyimide coating.
7. Disc: ASTM A-395 ductile iron with EPDM encapsulation.
8. Lower Bearing: Split metal.
9. Dust Plug: PVC
10. Rating: 300 psig CWP.
11. Conform To: MSS SP-67
12. Operator:
    a. Valves up to and including 6": Lever-lock operator.
    b. Valves 8" and larger: Self locking worm gear operator equipped with adjustable stops at open and shut positions.

D. Flanged 200 psig butterfly valves:
1. NIBCO Model FC-2765-0
2. Upper Stem: ASTM A-582 Type 416 Stainless steel.
3. Upper Bushing: TFE over porous bronze, steel backed.
4. O-Ring: EPDM
5. Body: ASTM A-126 Class B cast iron with polyimide coating.
6. Disc: ASTM A-395 ductile iron with EPDM encapsulation.
7. Lower Bushing: TFE over porous bronze, steel backed.
8. Lower Stem: ASTM A-582 Type 416 Stainless steel.
9. Dust Plug: PVC
10. Rating: 200 psig CWP.
11. Conform To: MSS SP-67 and MSS SP-25
12. Operator:
    a. Valves up to and including 6": Lever-lock operator.
    b. Valves 8" and larger: Self locking worm gear operator equipped with adjustable stops at open and shut positions.

E. Flanged 200 psig butterfly valves for Gas Service:
1. NIBCO Model FC-2765-0
2. Upper Stem: ASTM A-582 Type 416 Stainless steel.
3. Upper Bushing: TFE over porous bronze, steel backed.
4. O-Ring: EPDM
5. Body: ASTM A-126 Class B cast iron with polyimide coating.
6. Disc: ASTM A-395 ductile iron with EPDM encapsulation.
7. Lower Bushing: TFE over porous bronze, steel backed.
8. Lower Stem: ASTM A-582 Type 416 Stainless steel.
9. Dust Plug: PVC
10. Rating: 200 psig CWP.
11. Conform To: MSS SP-67 and MSS SP-25
12. Operator:
    a. Valves up to and including 6": Lever-lock operator.
    b. Valves 8" and larger: Self locking worm gear operator equipped with adjustable stops at open and shut positions.

2.6 BRONZE CHECK VALVES

A. Bronze, Horizontal Swing Check Valves:
1. NIBCO Model 413
2. Other Manufacturers:
   a. Milwaukee
   b. Stockham
3. Bonnet: ASTM B-62 bronze.
4. Body: ASTM B-62 bronze.
5. Hinge Pin: ASTM B-140 alloy C31400 bronze, or B-134 alloy C23000 bronze.
6. Disc Hanger:
   a. Sizes ¼" thru ¾": Type 304 stainless steel.
   b. Sizes 1" and larger: ASTM B-62 bronze.
7. Hanger Nut: ASTM B-16 bronze.
8. Disc Holder: ASTM B-62 bronze.
9. Seat Disc:
   a. Water and Other Heat Transfer Fluids: ASTM B-62 bronze.
   b. Steam: TFE
10. Seat Disc Nut: ASTM B-16 or B-62 bronze.
11. Hinge Pin Plug: ASTM B-140 alloy C31600 bronze.
12. Seat Disc Washer (When Provided): ASTM B-98 alloy C65500 or B-103 bronze.
13. Rating: 125 psig SWP and 200 psig CWP.
14. Conform To: MSS SP-80

B. Bronze, Inline Spring Loaded Check Valves:
1. Conbraco Industries-Apollo 61-100 series
2. Other Manufacturers:
   a. Milwaukee
   b. Stockham
   c. Nibco
3. Body: ASTM B-584 alloy C84400 bronze.
4. Retainer/Stem: ASTM B16 brass or ASTM A-582 alloy C30300 stainless steel.
5. Ball Check: RPTFE or
6. Disc Holder 316 Stainless steel
   a. Disc:
      1) Water, Oil, Gas: Buna-N
      2) Steam: TFE
   b. Seat Screw: ASTM A-276 alloy S43000 stainless steel.
   c. Body End: ASTM B-584 alloy C84400 bronze.
   d. Rating: 125 psig SWP and 250 psig CWP.
7. Guide: ASTM B16 Brass
8. Spring: Type 316 stainless steel.
9. Rating: 125 psig SWP and 400 psig WOG.

2.7 IRON BODY CHECK VALVES

A. Iron Body, Horizontal Swing Check Valves:
1. NIBCO Model 918-B
2. Other Manufacturers:

a. Milwaukee
b. Stockham

3. Body Bolt: ASTM A-307 steel.
4. Bonnet: ASTM A-126 class B cast iron.
5. Body Gasket: Synthetic Fibers.
6. Body Nut: ASTM A-307 steel
7. Side Plug: ASTM B-16 alloy C36000 Brass.
8. Hanger Pin: ASTM B-16 alloy C36000 Brass.
9. Hanger: ASTM B-584 alloy C84400 cast bronze.
10. Disc: ASTM B-584 alloy C84400 cast bronze or ASTM A-536 ductile iron w/bronze face ring.
11. Seat Ring: ASTM B-584 alloy C84400 cast bronze.
12. Disc Nut: ASTM B-16 alloy C36000.
13. Body: ASTM A-126 class B cast iron.
14. Disc Bolt: ASTM B-16 alloy C36000 Brass.
15. Disc Plate: ASTM A-126 class B cast iron.
16. Disc Cage: ASTM A-126 class B cast iron.
17. Rating: 125 psig SWP and 200 psig CWP.
18. Conform To: MSS SP-71 Type 1.

B. Grooved-End, Ductile-Iron Spring Assisted Check Valves: Victaulic Series 716 with EPDM disc seal.

C. Spring Actuated Silent Check Valves:
1. NIBCO Model F-910
2. Other Manufacturers:
a. Milwaukee
b. Stockham
3. Body: ASTM A48 class 35 cast iron.
4. Seat: ASTM B-584 alloy C83600 (B) bronze.
5. Disc: ASTM B-584 alloy C83600 bronze.
6. Spring: Type 302 ASTM A313 stainless steel.
7. Bushing:
a. 6" and Smaller: ASTM B-16 brass
b. 8" and Larger: ASTM B-584 alloy C83600 bronze.
8. Set Screws: Type 304 ASTM A-276 stainless steel.
9. Rating: 200 psig CWP.
10. Conform To: MIL-V-18436F

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully- pen to fully-closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for ball and butterfly valves 4" and larger and more than 96 inches above finished floor. Extend chains to 60 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
   3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust valve packing after piping systems have been tested and put into service but before final testing and balancing. Replace valves if persistent leaking occurs.

3.4 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball or butterfly valves.
   2. Throttling Service: Ball or butterfly valves.
   3. Pump Discharge: Spring-loaded, lift-disc check valves and ball or butterfly valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves:

1. Valves, NPS 2" and Smaller: Two-Piece, Copper-Alloy Ball Valves (Full Port).
2. Valves, NPS 2-1/2" and 3":
   a. Two-piece or three-piece, Copper-Alloy Ball Valves (Full Port).
   b. Wafer-Lug, grooved-end, or flanged butterfly valves.
3. Valves, NPS 4" and Larger: Wafer-Lug, grooved-end, or flanged butterfly valves.
4. Pump Discharge Check Valves (Horizontal or Vertical), NPS 2" and Smaller: Bronze, Inline Lift Check Valves.
5. Horizontal Check Valves, NPS 2" and Smaller: Bronze, Horizontal Swing Check Valves.
6. Vertical Check Valves, NPS 2" and Smaller: Bronze, Inline Lift Check Valves.
7. Pump Discharge Check Valves (Horizontal or Vertical), NPS 2-1/2" and Larger: Grooved-End, Ductile-Iron Spring Assisted Check Valves or Spring Actuated Silent Check Valves.
8. Horizontal Check Valves, NPS 2-1/2" and Larger: Bronze, Horizontal Swing Check Valves.
9. Vertical Check Valves, NPS 2-1/2" and Larger: Grooved-End, Ductile-Iron Spring Assisted Check Valves or Spring Actuated Silent Check Valves.

D. Gas Piping: Use the following types of valves:
1. Valves, NPS 2" and Smaller: Two-Piece, Copper-Alloy Ball Valves (Full Port).
2. Valves, NPS 2-1/2" and 3":
   a. Two-piece or three-piece, Copper-Alloy Ball Valves (Full Port).
   b. Wafer-Lug, grooved-end, or flanged butterfly valves.
3. Valves, NPS 4" and Larger: Wafer-Lug, grooved-end, or flanged butterfly valves.
4. Pump Discharge Check Valves (Horizontal or Vertical), NPS 2" and Smaller: Bronze, Inline Lift Check Valves.
5. Horizontal Check Valves, NPS 2" and Smaller: Bronze, Horizontal Swing Check Valves.
6. Vertical Check Valves, NPS 2" and Smaller: Bronze, Inline Lift Check Valves.
7. Pump Discharge Check Valves (Horizontal or Vertical), NPS 2-1/2" and Larger: Grooved-End, Ductile-Iron Spring Assisted Check Valves or Spring Actuated Silent Check Valves.
8. Horizontal Check Valves, NPS 2-1/2" and Larger: Bronze, Horizontal Swing Check Valves.
9. Vertical Check Valves, NPS 2-1/2" and Larger: Grooved-End, Ductile-Iron Spring Assisted Check Valves or Spring Actuated Silent Check Valves.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design Requirement: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer where using methods other than indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test medium.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

B. Trapeze Pipe Hanger Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Assemble and provide according to manufacturer's written instructions. Center piping on channel to evenly distribute load.

2. Pipe sizes and numbers shall be in accordance with the following:

TRAPEZE PIPE HANGER TABLE

PIPE SIZE	4"	3"	2 ½"	2"	1 ½"	1 ¼"	1"	TOTAL # of PIPES
NUMBER OF PIPES PERMITTED IN ONE CHANNEL SUPPORT	**2**	0	0	0	0	0	0	**2**
	0	**2**	**2**	0	0	0	0	**4**
	0	**2**	0	**4**	0	0	0	**6**
	0	**2**	0	0	**6**	0	0	**8**
	0	0	**4**	**2**	0	0	0	**6**
	0	0	**4**	0	**2**	**2**	0	**8**
	0	0	**4**	0	0	**8**	0	**12**

	0	0	0	**6**	**2**	**2**	**2**	**12**
	0	0	0	**8**	0	**2**	0	**10**
	0	0	0	0	**14**	0	0	**14**
	0	0	0	0	0	**16**	0	**16**

Notes:

1. Piping larger than 4" in diameter is not permitted in a channel support system.
2. Channel support systems shall be limited to eight (8) pipes per channel and two (2) channels (levels) per support system.
3. Smaller pipes can be substituted for larger pipes. For example two ¾" pipes may be installed in lieu of two 1" pipes, or 2" in lieu of 3", etc.
4. Spacing shall be in accordance with requirements for the smallest supported pipe. Refer to other specification sections for spacing requirements. If spacing requirements are not indicated comply with MSS SP-69.

C. Metal Framing Systems:

1. Available Manufacturers:
   a. Anvil International; a subsidiary of Mueller Water Products Inc.
   b. Empire Industries, Inc.
   c. ERICO International Corporation.
   d. Haydon Corporation; H-Strut Division.
   e. NIBCO INC.
   f. PHD Manufacturing, Inc.
   g. PHS Industries, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Available Manufacturers:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.

6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig, ASTM C 552, Type II cellular glass with 100-psig, or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2" beyond sheet metal shield for piping operating below ambient air temperature.

2.4 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

1. Available Manufacturers:

   a. Cooper B-Line – Dura-Blok
   b. MAPA Products
   c. Mifab, Inc. – C-Port
   d. Miro Industries, Inc.
   e. OMG, Inc.
   f. PHP Systems/Design
   g. Pipe Prop
   h. Roof Top Blox

2. Provide pipe supports for supporting gas, condensate, refrigeration lines, or hyrdronic piping on flat roof surfaces. Support shall rest on roof surface without penetrating the roof surface. Supports for condensate piping shall be adjustable vertically to ensure pipe slopes as required.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Curb Mounted Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment support made from structural carbon-steel shapes unless indicated otherwise.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69, MSS SP-89, and Table above. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Provide in pipe hanger or shield for insulated piping.

E. Pipe Stand Installation: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

F. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Provide hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Provide lateral bracing with pipe hangers and supports to prevent swaying.

J. Provide building attachments within concrete slabs or attach to structural steel. Building attachments may not used on steel joists unless otherwise indicated. Provide additional attachments

at concentrated loads, including valves, flanges, and strainers, 2-1/2" and larger and at changes in direction of piping. Provide concrete inserts before concrete is placed; fasten inserts to forms and provide reinforcing bars through openings at top of inserts.

K. Load Distribution: Provide hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Provide hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Provide thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Provide MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Provide MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. Shield Dimensions for Pipe: Not less than the following:

   a. Pipe ¼" to 3-½": 12 inches long and 0.048 inch thick.
   b. Pipe 4": 12 inches long and 0.06 inch thick.
   c. Pipe 5" and 6": 18 inches long and 0.06 inch thick.
   d. Pipe 8" to 14": 24 inches long and 0.075 inch thick.

5. Pipes 8" and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Provide with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Provide materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Unless otherwise indicated clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Provide same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and immediately apply galvanizing-repair paint. Paint shall comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Provide hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Provide nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Provide copper-plated pipe hangers and copper attachments for copper piping and tubing.

F. Provide padded hangers for piping that is subject to scratching.

G. Provide thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated provide the following:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of stationary pipes ½" to 30".
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes 4" to 14", requiring up to 4" of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes ¾" to 14", requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes ½" to 14" if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes ½" to 4", to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes ¾" to 8".
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes ½" to 8".
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes ½" to 8".
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes ½" to 8".
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes ½" to 8".
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS ½" to 3".
12. U-Bolts (MSS Type 24): For support of heavy pipes ½" to 14".
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes 4" to 14", with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes 4" to 14", with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes 2-½" to 14" if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes 1" to 14", from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes 2-½" to 14", from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes 2" to 14" if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes 2" to 14" if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes 2" to 14"if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated provide the following:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers ¾" to 14".
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers ¾" to 14" if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated provide the following:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
6. Flat Plate, Double Nut, and Washer as Detailed on Structural Drawings: For attaching to bar joists. Method of attachment to bar joists must be approved by the structural engineer and joist manufacturer.

K. Building Attachments: Unless otherwise indicated provide the following:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Flat Plate, Double Nuts, and Washer as Detailed on Structural Drawings: For use under roof installations with bar-joist construction to attach to bottom chord of joist.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Provide one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated provide the followings:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated provide the following:

1. Restraint-Control Devices (MSS Type 47): To control pipe movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Provide powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where indicated in concrete construction.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve Schedules: For each piping system to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, Aluminum, or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

1. Stencil Material: Metal or fiberboard.
2. Stencil Paint: Exterior, gloss, black, unless otherwise indicated. Paint shall be low VOC and shall meet the requirements of section 09910. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, in colors according to ASME A13.1, unless otherwise indicated. Paint shall be low VOC and shall meet the requirements of section 09910.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick brass or
2. Material: 0.0375-inch- thick stainless steel or
3. Material: 3/32-inch- thick laminated plastic with 2 black surfaces and white inner layer.

B. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.6 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws and hangers.
2. Frame: Finished hardwood or extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.7 VALVE PLAN

A. Valve Plan: Prepare a scale drawing. Provide the location and identity of each valve.

1. Valve Plan Frames: Glazed display frame for removable mounting on masonry walls for each page of valve plan. Include mounting screws and hangers.
2. Frame: Finished hardwood or extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.8 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install and permanently fasten equipment nameplates on each major item of plumbing equipment that does not have nameplate, or has a nameplate that is damaged or located where not easily visible. Locate nameplates where easily visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units.
2. Pumps, compressors, and other motor-driven equipment.
3. Heat exchangers and similar equipment.
4. Water heaters and storage tanks.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Meters, gages, and thermometers.
   c. Fuel-burning units.
   d. Pumps, compressors, and other motor-driven equipment.
   e. Heat exchangers and similar equipment.
   f. Water heaters and storage tanks.

C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where easily visible.

1. Identify mechanical equipment with equipment markers in the following color codes:
   a. Green: For cooling equipment and components.
   b. Yellow: For heating equipment and components.
   c. Orange: For combination cooling and heating equipment and components.
   d. Brown: For energy-reclamation equipment and components.
   e. Blue: For equipment not listed in a through d
2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

E. Install access panel markers with screws on equipment access panels.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in other sections.

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.]

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Domestic Cold Water Piping:

   a. Background Color: Green.
   b. Letter Color: White.

2. Domestic Hot Water Piping:

   a. Background Color: Green.
   b. Letter Color: White.

3. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Green.
   b. Letter Color: White.

4. Natural Gas Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:

   a. Domestic Cold Water: 1 ½", round.
   b. Domestic Hot Water: 1 ½", round.
   c. Domestic Hot Water Recirculation: 1 ½", round.
   d. Natural gas: 2", round.

2. Valve-Tag Color:

   a. Domestic Cold Water: Blue.
   b. Domestic Hot Water: Red.
   c. Domestic Hot Water Recirculation: Red.
   d. Natural gas: Yellow.

3. Letter Color:

   a. Domestic Cold Water: Black.
   b. Domestic Hot Water: White.
   c. Domestic Hot Water Recirculation: White.
   d. Natural gas: 2", Black.

3.5 VALVE SCHEDULE INSTALLATION

A. Mount valve schedules on wall in accessible location in each major equipment room and where directed by owner.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

A. Clean faces of mechanical identification devices and glass fronts of valve schedules and plans.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Outdoor pipe: Pipe located outside the building insulation envelope.

B. Plenum: An unoccupied space or void, on the conditioned side of the building insulation and vapor barrier, being used to return conditioned air to the inlet side of a return or exhaust fan either directly or via a duct connection. An example would be a space with air handling light fixtures or openings in the ceiling used to transport air through the ceiling and then to an open duct located above the ceiling in another location.

C. Indirectly Conditioned Space: A space having no direct conditioning but, due to air movement induced by an exhaust, or return opening, is conditioned by makeup air from an adjacent space. An example would be a small toilet. Boiler rooms, fan rooms, and mechanical rooms do not qualify as indirectly conditioned spaces.

D. Inside the Building Insulation Envelope: For the purposes of this section, boiler rooms, fan rooms, and mechanical rooms are considered to be OUTSIDE the building insulation envelope.

E. Exposed: Visible from any angle without removal of building element or equipment.

F. Concealed: Enclosed in building element or above ceiling such that it is not visible from any angle without removal of building element or equipment.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Detail application of removable insulation covers.
2. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
3. Detail attachment and covering of heat tracing inside insulation.
4. Detail insulation application at pipe expansion joints for each type of insulation.
5. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
6. Detail removable insulation at piping specialties, equipment connections, and access panels.
7. Detail application of field-applied jackets.
8. Detail application at linkages of control devices.
9. Detail field application for each equipment type.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with type, grade, and maximum use temperature.

B. Ship Insulated Piping System Components on pallets and wood supports. Securely fasten and protect from damage. Store off the ground and cover with opaque waterproof tarp to protect materials from sunlight and rain.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation, duct Installer for duct insulation, and equipment Installer for equipment insulation.

C. Maintain clearances required for maintenance.

D. Coordinate installation and testing of heat tracing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers:

1. Mineral-Fiber Insulation:
   a. CertainTeed Manson.
   b. Johns Manville
   c. Knauf FiberGlass GmbH.
   d. Owens-Corning Fiberglas Corp.
   e. Schuller International, Inc.
2. Flexible Elastomeric Thermal Insulation:
   a. Armstrong World Industries, Inc.
   b. Rubatex Corp.
3. Polyolefin Insulation:
   a. Armstrong World Industries, Inc.
   b. IMCOA.
4. Closed-Cell Phenolic-Foam Insulation:
   a. Kooltherm Insulation Products, Ltd.

5. Removable Insulation Covers:
   a. Advance Thermal Corp.

2.2 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Board: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, with factory applied FSK Jacket. Meet the requirements of ASTM C 1290, Type III, inorganic glass fibers bonded by a thermosetting resin to maximum service temperature of 250°F.. Faced insulation shall not exceed 25 Flame Spread, 50 Smoke Developed when tested in accordance with ASTM E84.

G. Semi-Rigid Mineral-Fiber Board: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 1136, Type I, II, III, & IV with factory applied all-service jacket (ASJ) or Type II, IV with factory applied Foil Scrim Kraft (FSK) jacket.

H. Mineral-Fiber Pipe Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
2. Semi-Rigid Mineral-Fiber Board: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 1136, Type I, II, III, IV with factory applied all-service jacket (ASJ) or Type II, IV with factory applied Foil Scrim Kraft (FSK) jacket.
3. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
4. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
5. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

I. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

J. Closed-Cell Phenolic-Foam: Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.

K. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Glass Cloth: Woven glass-fiber fabric, plain weave, minimum 8 ounces per square yard.

C. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

D. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.
2. PVC Duct Jacket Color: White or gray.
3. PVC Pipe Jacket Color: Color-code piping jackets based on materials contained within the piping system.

E. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209, and having an integrally bonded moisture barrier over entire surface in contact with insulation. Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.

1. Finish and Thickness: Stucco-embossed finish, 0.016 inch thick.
2. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.
3. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

F. Stainless-Steel Jacket: Deep corrugated sheets of stainless steel complying with ASTM A 666, Type 304 or 316; 0.10 inch thick; and roll stock ready for shop or field cutting and forming to indicated sizes.

1. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.
2. Elbows: Gore type, for 45- and 90-degree elbows in same material, finish, and thickness as jacket.
3. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.

G. Heavy PVC Pipe Fitting Covers: Factory-fabricated fitting covers manufactured from 30-mil-thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

H. Standard PVC Pipe Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

2.4 REMOVABLE INSULATION COVERS

A. Pre-manufactured easily removable insulation cover/blanket intended for insulation of equipment and devices requiring periodic maintenance.

2.5 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd..

1. Tape Width: 4 inches.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
2. Galvanized Steel: 0.005 inch thick.
3. Aluminum: 0.007 inch thick.
4. Brass: 0.010 inch thick.
5. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

D. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.

1. Welded Pin Holding Capacity: 100 lb for direct pull perpendicular to the attached surface.

E. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct, pipe, plenum and breeching with adhesive. Pin length sufficient for insulation thickness indicated.

1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, pipes, plenums, and breechings; and to achieve a holding capacity of 100 lb. for direct pull perpendicular to the adhered surface.

F. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct, pipe, and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.6 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

2.7 REMOVABLE INSULATION COVERS

A. Pre-manufactured easily removable insulation cover/blanket intended for insulation of equipment and devices requiring periodic maintenance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of piping, and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thickness required for each system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with seams staggered.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

G. Keep insulation materials dry at all times. Insulation that becomes wet or is otherwise damaged beyond repair, shall be removed immediately and replaced. Replacement material and installation shall be in accordance with these specifications.

H. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

I. Apply insulation with the minimum number of joints practical.

J. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

K. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.

3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges, pipe joints, and fittings.

O. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

P. Install vapor-retarder mastic on ducts, pipes, plenums, and equipment.

1. Ducts, pipes, plenums, and equipment with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
2. Ducts, pipes, plenums, and equipment without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

Q. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

S. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

T. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Board Applications for Ducts, Plenums, & Equipment: Secure board insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct, plenum, & equipment surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings, transitions, and equipment. Adhesive may be omitted from top surface of horizontal rectangular ducts.
3. Space anchor pins as follows:
   a. On duct & equipment sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct & equipment sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at bracing.
   c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not compress insulation to less than 75% of its original thickness during installation.

4. Cut excess portion of pins extending beyond speed washers. Cover exposed pins and washers with tape matching insulation facing.
5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1-inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct and equipment stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6" wide strips of the insulating materia. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to ducts, plenums, and equipment as follows:

1. Follow the manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct, plenum, and equipment surface.

3.6 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

A. Apply insulation as follows:

1. Secure each layer of insulation with stainless-steel bands at 12-inch intervals and tighten without deforming the insulation materials.
2. Apply two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch, soft-annealed, stainless steel wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
3. On exposed applications, finish insulation with a skim coat of mineral-fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

3.7 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.8 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as indicated.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color shall be as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.9 APPLICATIONS

A. Insulation materials and thickness are specified at the end of this Section.

B. Insulate all pipe and equipment:

1. Insulate pipe in accordance with the application schedule(s) below.
2. Exceptions: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
   a. Vibration-control devices.
   b. Testing agency labels and stamps.
   c. Nameplates and data plates.
   d. Manholes.
   e. Handholes.
   f. Cleanouts.
   g. Plastic Condensate Drain piping.
   h. Factory-insulated equipment.
   i. Flexible connectors.

3.10 INDOOR APPLICATION SCHEDULE (ABOVE GRADE):

A. Service: Domestic hot water and domestic circulated hot water.

1. Insulation Material: Mineral fiber preformed or flexible elastomeric pipe insulation.
2. Insulation Thickness: Apply the following insulation thicknesses:
   a. Copper Pipe, ½" through 1½" in diameter: 1"
   b. Copper Pipe, 1½" through 3" in diameter: 1 ½"
   c. Copper Pipe, larger than 3" in diameter: 2"
3. Vapor Retarder Required: No.
4. Finish: Exposed = Painted, concealed = none.

B. Service: Domestic cold water.

1. Insulation Material: Mineral fiber preformed or flexible elastomeric pipe insulation.
2. Insulation Thickness: ½"
3. Vapor Retarder Required: Yes.
4. Finish: Exposed = Painted, concealed = none.

C. Service: Rainwater conductors (Including secondary roof drain conductors). Insulate first thirty linear feet of piping including vertical piping from drain body and first horizontal piping run. If a second vertical run occurs before thirty linear feet is reached, terminate insulation at end of first horizontal run.

1. Insulation Material: Mineral fiber preformed pipe insulation with Factory Applied FSK Jacket.
2. Insulation Thickness: 1"
3. Vapor Retarder Required: Yes.
4. Finish: Exposed = Painted, concealed = none.

D. Service: Roof drain and overflow drain bodies.

1. Insulation Material: Semi-Rigid Mineral-Fiber Board Thermal Insulation
2. Insulation Thickness: 1½"
3. Vapor Retarder Required: Yes.
4. Finish: Exposed = Painted, concealed = none.

E. Service: Exposed piping:
1. Mineral fiber preformed pipe insulation with Factory Applied FSK Jacket.
2. Insulation Thickness: 1"
3. Vapor Retarder Required: Yes.
4. Finish: Exposed = Painted, concealed = none.

F. Service: Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Drainage from any Equipment. Measurement shall be pipe length.
1. Insulation Material: Mineral fiber preformed pipe insulation with Factory Applied FSK Jacket.
2. Insulation Thickness: 1"
3. Vapor Retarder Required: Yes.
4. Finish: Exposed = Painted, concealed = none.

G. Service: Condensate Drains, & Traps.
1. Insulation Material: Mineral fiber preformed pipe insulation with Factory Applied FSK Jacket.
2. Insulation Thickness: 1"
3. Vapor Retarder Required: Yes.
4. Finish: Exposed = Painted, concealed = none.

H. Service: Equipment Non-condensate Drains, & Traps.
1. Insulation Material: Mineral fiber preformed pipe insulation with Factory Applied FSK Jacket.
2. Insulation Thickness: 1"
3. Vapor Retarder Required: Yes.
4. Finish: Exposed = Painted, concealed = none.

3.11 INDOOR APPLICATION SCHEDULE (BELOW GRADE):

1. None required.

END OF SECTION 220700

SECTION 221113 – FACILITY NATURAL-GAS PIPING

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.
3. Service Meter: 65 psig minimum unless otherwise indicated.

B. Gas System Pressures: Primary pressure from the utility is more than 2.0 psig, and is reduced to a secondary pressure of 2.0 psig by a pressure reducing valve installed immediately downstream of the meter, and is reduced again by pressure reducing valves located at each piece of equipment.

1.4 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings bypass fittings and meter bars meter bars.
6. Dielectric fittings.

B. Operation and Maintenance Data: For motorized gas valves, pressure regulators, and service meters to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components and Devices: If indicated, provide electrical components and devices that are listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Applicable Codes: Comply with the 2015 South Carolina Fuel Gas Code.

C. Fuel Gas Piping: Listed and labeled as required by the 2015 South Carolina Fuel Gas Code.

D. UL Standard: Provide components listed in UL's "Gas and Oil Equipment Directory" where UL listing is indicated.

E. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

F. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.7 PROJECT CONDITIONS

A. Perform site survey: Contract with utility-locating service for area where Project is located, and locate utilities.

B. Design values of fuel gas supplied for these systems are as follows:

1. Nominal Heating Value: 1000 Btu/cu.ft.
2. Nominal Specific Gravity: 0.60

C. Interruption of Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after

arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Architect and Owner's written permission.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
   3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
   4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1.
      b. End Connections: Threaded or butt welding to match pipe.
      c. Lapped Face: Not permitted underground.
      d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
      e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
   5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
      a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.3 POLYETHLENE PIPE, FITTINGS, AND JOINING MATERIALS

A. Available Manufacturers:

1. ERS Inc.
2. Titeflex Corp.

B. Polyethlene Pipe: Pipe shall be produced for use in gas distribution systems in accordance with the latest published edition of ASTM D 2513 Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.

C. Polyethlene Fittings: Fittings shall be produced for use in gas distribution systems in accordance with the latest published edition of ASTM D 2513 Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.

D. Joining Materials: Joining materials shall be as recommended by the pipe and fitting manufacturer for service intended.

2.4 PROTECTIVE COATING

A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in corrosive atmosphere.

2.5 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.6 VALVES

A. Refer to section "General Duty Valves for Plumbing Piping".

2.7 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72"

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.

2. End Connections: Threaded ends for 2" and smaller; flanged ends for 2 ½" and larger.
3. Strainer Screen: 40-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.8 SPECIALTY VALVES

A. Available Manufacturers:

1. ASCO General Controls.
2. Automatic Switch Co.
3. Eaton Corp.; Controls Div.
4. Honeywell, Inc.
5. Johnson Controls, Inc.

B. Automatic Gas Valves: ANSI Z21.21, with electrical or mechanical operator for actuation by appliance automatic shutoff device.

2.9 Valves, 2" and Smaller: Ball valves with threaded ends according to ASME B1.20.1 for pipe threads.

2.10 Valves, 2-1/2" and Larger: Butterfly valves for use with flanged ends according to ASME B16.5 for steel flanges.

2.11 PRESSURE REGULATORS

A. Available Manufacturers:

1. Line Pressure Regulators:
   a. American Meter Co.
   b. Donkin: Bryan Donkin RMG Canada, Ltd.
   c. Eclipse Combustion, Inc.
   d. Equimeter, Inc.
   e. Fisher Controls International, Inc.
   f. Maxitrol Co.
   g. National Meter.
   h. Richards Industries, Inc.; Jordan Valve Div.
   i. Schlumberger Industries; Gas Div.

B. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.

1. 2" and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

2. 2 ½" and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
3. Line Pressure Regulators: ANSI Z21.80 with 5-psig minimum inlet pressure rating.
4. Appliance Pressure Regulators: ANSI Z21.18 with 2-psig minimum inlet pressure. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction. If vents are required provided piping necessary to extend to termination location outside the building as approved by the architect.

C. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping. Extend to exterior of building and terminate in location approved by the architect.

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Available Manufacturers:

   a. Canadian Meter Company Inc.
   b. Eaton Corporation; Controls Div.
   c. Harper Wyman Co.
   d. Maxitrol Company.
   e. SCP, Inc.
2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig.

2.12 CONCRETE BASES

A. Description: Reinforced concrete base formed of 3000-psi- minimum, 28-day compressive strength concrete, and measuring 6 inches thick and 6 inches larger in each dimension than equipment, unless otherwise indicated.

2.13 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Available Manufacturers:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
   f. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Available Manufacturers:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
   d. Wilkins; Zurn Plumbing Products Group.
2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Available Manufacturers:

   a. Advance Products & Systems, Inc.
   b. Calpico Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.
2. Minimum Operating-Pressure Rating: 150 psig.
3. Companion-flange assembly for field assembly.
4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.14 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

B. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to fuel gas distribution piping downstream of meter.

1. Service meter will be provided by Local Gas Utility.

B. Install dielectric fitting downstream from and adjacent to each service meter unless meter is supported from service-meter bar with integral dielectric fitting. Install shutoff valve downstream from and adjacent to dielectric fitting. Refer to Division 22 Section "Common Work Results for Plumbing" for dielectric fittings.

3.4 CONCRETE BASE INSTALLATION

A. Locate bases at service meters and service regulators.

B. Excavate earth and make level beds to support bases. Form and pour concrete bases level with top surface projecting approximately 3 inches above grade.

3.5 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

E. Copper Tubing Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.Install fittings for changes in direction and branch connections.

F. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Section "Meters and Gages for Plumbing Piping."

3.6 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to are accepted by architect.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms.

E. Install piping indicated to be exposed and piping in equipment rooms at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and

same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install pre-sleeved corrugated, stainless-steel tubing systems for natural-gas. Cover with minimum of 1-1/2 inches of concrete. Jacket may not be in physical contact with metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives.
3. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
    a. Exception: Tubing passing through partitions or walls does not require striker barriers.
4. Prohibited Locations:
    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes 2" and smaller, adjacent to each valve, at final connection to each piece of equipment and where otherwise indicated. Unions are not required at flanged connections.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Section "Meters and Gages for Plumbing Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

Y. Install corrugated, stainless-steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

Z. Install containment casings for gas piping below slabs extending minimum of 2 inches beyond point where pipe emerges from the floor. Tightly seal ends around gas piping using mechanical sleeve seals.

3.7 SERVICE-METER ASSEMBLY INSTALLATION

A. Provide concrete base for service meter.

B. Install locking shutoff valves downstream from service regulator. Shutoff valves are not required at second regulator if two regulators are installed in series.

C. Install strainer on inlet of service-pressure regulator.

D. Install service pressure regulator mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.

3.8 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.9 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not over-tighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.10 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. 1" and Smaller: Maximum span, 96"; minimum rod size, 3/8".
2. 1¼": Maximum span, 108"; minimum rod size, 3/8".
3. 1½" and 2": Maximum span, 108"; minimum rod size, 3/8".
4. 2½" to 3 ½": Maximum span, 10'-0"; minimum rod size, ½".
5. 4" and Larger: Maximum span, 10'-0"; minimum rod size, 5/8".

3.11 CONNECTIONS

A. Connect to utility's gas meter according to utility's procedures and requirements.

B. Install piping adjacent to appliances to allow service and maintenance of appliances.

C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72" of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.12 PIPING APPLICATIONS

A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.

B. Above Ground Exposed Fuel Gas Piping:

1. Sizes up to 2":
   a. Steel pipe, malleable-iron threaded fittings, and threaded joints.
2. 2½" to 4": Steel pipe, malleable-iron threaded fittings, and threaded joints, or steel pipe, steel welding fittings, and welded joints.
3. Larger Than NPS 4: Steel pipe, steel welding fittings, and welded joints.

C. Above Ground Concealed Fuel Gas Piping:

1. Sizes up to 2":
   a. Steel pipe, malleable-iron threaded fittings, and threaded joints.
2. 2½" to 4": Steel pipe, malleable-iron threaded fittings, and threaded joints, or steel pipe, steel welding fittings, and welded joints.
3. Larger Than NPS 4: Steel pipe, steel welding fittings, and welded joints.

D. Exterior Underground Fuel Gas Piping:

1. All Sizes: Polyethylene pipe, fittings and joining materials.

E. Under Slab Fuel Gas Piping: (NOTICE: Method of fuel gas piping installation below floor slab must be approved by the local code authority.)

1. Pre-Sleeved Corrugated, Stainless-Steel Tubing Systems.
2. Steel pipe, steel welding fittings, and welded joints with welded steel vented conduit.

3.13 LABELING AND IDENTIFYING

A. Comply with requirements in Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12" minimum below finished grade.

1. Exception: 6 minimum below sub-grade under pavements and slabs.

3.14 PAINTING

A. Use materials and procedures in Division 9 Section "Painting," "Exterior Paint Schedule" Article, "Ferrous Metal" Paragraph, "Full-Gloss, Alkyd-Enamel Finish" Subparagraph.

B. Paint exterior service meters, pressure regulators, specialty valves, and piping.

1. Color: Gray.

3.15 FIELD QUALITY CONTROL

A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging," and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

D. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete.

3.16 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION 221113

SECTION 221116 –DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
   1. Domestic Water Service Piping: 160 psig.
   2. Domestic Water Distribution Piping: 125 psig.

1.3 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

C. Mechanically formed outlets: Branch connections utilizing the T-Drill method of forming outlets and making branch connections.

D. Press fittings:
   1. Propress by Vieaga
   2. Xpress by Elkhart Products

a. and nuts.

2.2 COPPER TUBING

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

a. Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to other sections for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Fitting Options:
1. Press Fittings: Mechanically crimped fittings with neoprene gasket.

E. Underground Domestic Water Service Piping: Match civil materials to first flange.

F. Aboveground Domestic Water Piping: Use the following piping materials for each size range:

1. 1-1/2" and Smaller: Hard copper tube, Type L copper pressure fittings; and soldered joints.
2. 2": Hard copper tube, Type L copper pressure fittings; and soldered joints or hard copper tube, Type L with grooved ends; copper grooved-end fittings; copper-tubing, keyed couplings; and grooved joints.
3. 2-1/2" and above": Hard copper tube, Type L copper pressure fittings; and soldered joints or hard copper tube, Type L with grooved ends; copper grooved-end fittings; copper-tubing, keyed couplings; and grooved joints.

G. Underground Domestic Water Piping: Use the following piping materials for each size range:
1. 2" and Smaller: Soft copper tube, Type K copper pressure fittings; and soldered joints with no joints permitted below concrete slabs.
2. 2-1/2" and above: Soft copper tube, Type K copper pressure fittings; and soldered joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water-Piping, Balancing Duty: Use automatic flow control valves.
4. Drain Duty: Hose-end drain valves.

B. Grooved-end valves may be used with grooved-end piping.

3.4 PIPING INSTALLATION

A. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.

B. Install underground copper according to CDA's "Copper Tube Handbook."

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

D. Install aboveground domestic water piping level and plumb.

E. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

F. Perform the following steps before operation:
1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.

4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

G. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

H. Check plumbing specialties and verify proper settings, adjustments, and operation.
1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.

I. Energize pumps and verify proper operation.

3.5 JOINT CONSTRUCTION

A. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

B. Grooved Joints: Assemble joints with keyed-coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Mechanically crimped fittings shall be installed in accordance with manufacturer's installation instructions.

3.6 VALVE INSTALLATION

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.

C. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger.

3.7 HANGER AND SUPPORT INSTALLATION

A. Refer to Section 220529 "Hangers and Supports for Plumbing Piping" for pipe hanger and support devices.

B. Install the following:
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

H. Where bends in the pipe occur, place hangers 1/3 of the maximum allowed spacing distance of the bend (i.e. is the maximum span is 12 feet, the hanger shall be 4 feet from the bend. Pipe shall be supported from both sides of the bend.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

3.9 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:
1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.10 ADJUSTING

A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.

3.11 CLEANING

A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

B. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in AWWA C651, AWWA C652 or as described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities to authorities having jurisdiction.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product proposed.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance: Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type (Anti-siphon)Vacuum Breakers:

1. Available Manufacturers:
    a. Ames Co.
    b. Apollo Valves - Apollo Valves - Conbraco Industries, Inc.
    c. Watts Industries, Inc.; Water Products Div.
    d. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1001.
3. Sizes: ¾" thru 3" as required to match connected piping.

4. Body: Brass or Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze or chrome plated.

B. Pressure Vacuum Breakers:

1. Available Manufacturers:
   a. Ames Co.
   b. Apollo Valves - Apollo Valves - Conbraco Industries, Inc.
   c. Watts Industries, Inc.; Water Products Div.
   d. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Accessories:
   a. Valves: Ball type, on inlet and outlet.

C. Spill-Resistant Vacuum Breakers:

1. Available Manufacturers:
   a. Apollo Valves - Apollo Valves - Conbraco Industries, Inc.
   b. Watts Industries, Inc.; Water Products Div.
2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Sizes: ¾" thru 1" as required to match connected piping.
5. Accessories:
   a. Valves: Ball type, on inlet and outlet.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Zone (RPZ) Backflow Preventers:

1. Available Manufacturers:
   a. Ames Co.
   b. Apollo Valves - Apollo Valves - Conbraco Industries, Inc.
   c. Watts Industries, Inc.; Water Products Div.
   d. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 10 psig maximum, through middle 1/3 of flow range.
5. Sizes: ¾" thru 10"
6. Body: Brass or bronze for 2" and smaller; cast iron or steel with interior lining complying with AWWA C550 or that is FDA approved for 2 ½" and larger.
7. Configuration: Comply with drawing requirements.

8. Accessories:
    a. Valves: Ball type with threaded ends on inlet and outlet of 2" and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of 2 ½" and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.3 AUTOMATIC FLOW CONTROL VALVES

A. Manufacturers:
1. Bell & Gossett
2. Flow Design, Inc.
3. Griswold Controls
4. Hays Fluid Controls
5. Pro Hydronic Specialties

B. Valves shall be factory set to maintain constant flow with plus or minus 10 percent. Each valve shall have an identification tag attached by chain, and be factory marked with the zone or equipment identification, valve number, and flow rate. Valve shall be line size and as follows:
1. Body: Gray-iron or brass, designed for 175 psig at 200 deg For; brass or ferrous-metal, designed for 300 psig at 250 deg F.
2. Cartridge: Stainless steel or nickel chrome plated brass, tamperproof, self-cleaning, piston-spring assembly, or polyphenylsulfone orifice seat with polymer diaphragm (Hays) removable for inspection or replacement.
3. Adjustment: Flow and pressure differential shall be adjustable by cartridge replacement.
4. Configuration: "Y" or other permitting cartridge replacement without valve removal for sizes 2" and smaller.
5. Sizes: Match connecting pipe.
6. Accessories:
    a. Provide unions and isolation valves or other configuration permitting cartridge replacement with valve removal for sizes larger than 2."
    b. Minimum pressure differential shall not exceed 2 psi (unless otherwise indicated)
    c. Maximum pressure differential shall not be less than 32 psi (unless otherwise indicated).
    d. Flow rates shall be as indicated on equipment schedules on the drawings.
    e. Valves shall be installed in return piping.
    f. Ball valves and unions included as part of the valve package may be used in place of ball valves and unions specified and indicated on the drawings only when in positions indicated. Ball valves shall be provided with a solid stainless steel or chrome plated brass ball.
    g. Provide a #20 mesh Y-strainer with blow-down valve and garden hose connection between the supply side valve and equipment.
    h. Valves may be provided as part of a "hose kit."

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Thermostatic Water Mixing Valves:
1. Refer to drawing schedule for manufacturer and operating requirements.
2. Available Manufacturers:

a. Lawler Manufacturing Company, Inc.
b. Leonard Valve Company.
c. Powers; a Watts Industries Co.
d. Symmons Industries, Inc.

3. Standard: ASSE 1017.
4. Pressure Rating: 125 psig.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: union inlets and outlet.
7. Accessories:
   a. Check stops on hot- and cold-water supplies.
   b. Handle.
   c. Dial thermometer on inlets and outlet.
   d. Pressure gauges on inlets and outlet.
8. Pressure Rating: 125 psig, unless otherwise indicated.

B. Individual-Fixture, Water Tempering Valves:

1. Refer to drawing schedule for manufacturer and operating requirements.
2. Available Manufacturers:
   a. Apollo Valves - Conbraco Industries, Inc.
   b. Lawler Manufacturing Company, Inc.
   c. Leonard Valve Company.
   d. Powers; a Watts Industries Co.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Plumbing Products Group; Wilkins Div.
3. Standard: ASSE 1016, thermostatically controlled water tempering valve.
4. Pressure Rating: 125 psig minimum, unless otherwise indicated.
5. Body: Bronze body with corrosion-resistant interior components.
6. Temperature Control: Adjustable.
7. Inlets and Outlet: Threaded. Provide unions and valves.
8. Finish: Chrome-plated bronze.

2.5 STRAINERS

A. Pattern: "Y"

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron or steel with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller;flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

a. StrainersNPS 2 and Smaller: 0.033 inch.
b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.6 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Field-installed, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish: Chrome or nickel plated.
9. Operation: Operating key.
10. Include operating key with each hose bibb.
11. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.7 WALL HYDRANTS

A. Refer to plumbing fixture rough-in schedule on drawings.

2.8 WATER HAMMER ARRESTERS

A. Available Manufacturers:
1. AMTROL, Inc.
2. Josam Company.
3. MIFAB, Inc.
4. PPP Inc.
5. Sioux Chief Manufacturing Company, Inc.
6. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
7. Tyler Pipe; Wade Div.
8. Watts Drainage Products Inc.
9. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Standard: ASSE 1010 or PDI-WH 201.

C. Type: Metal bellows or copper tube with piston.

D. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.9 TRAP GUARD

A. Available Manufacturers:
1. ProSet Systems, Model TG
2. SureSeal Manufacturing, Inline Floor Drain Trap Sealer

B. General:
1. Comply with ASSE 1072-2007.
2. ProSet Systems: Smooth, soft, flexible, elastomeric PVC material molded into shape, open on top with curl closure at bottom. SureSeal: ABS plastic body with neoprene rubber diaphragm and sealing gasket with 80 durometer compression fit sealing gasket on gravity drain outlet connection.
3. Allows wastewater to open and adequately discharge floor drain through its interior.
4. Closes and returns to original molded shape after wastewater discharge is complete.
5. Size shall be as required to match drain in which it is installed.

2.10 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers:

a. MIFAB, Inc.
b. PPP Inc.
c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Valves:
1. Available Manufacturers:

a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

2.11 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:
1. Available Manufacturers:

2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. PPP Inc.

3. Standard: ASSE 1044
4. Piping: ASTM B 88, Type L; copper, water tubing.
5. Cabinet: Unless otherwise indicated, recessed or surface-mounting steel box with stainless-steel cover.
6. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
7. Vacuum Breaker: ASSE 1001.
8. Number of Outlets: Refer to drawings.
9. Size of Outlets: ½"

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers where indicated: If not indicated on each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install balancing valves with-in 12" of ceiling at access door or tile where they can be reached with-out obstruction.

D. Install thermostatic mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and pressure gauges.
2. Install cabinet-type units recessed in or surface mounted on wall as indicated.

E. Install strainers where indicated.

F. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Section "Rough Carpentry."

G. Install water hammer arresters in water piping according to PDI-WH 201.

H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1/8" per foot, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

I. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1/8" per foot, and connect to floor-drain body, trap, or inlet fitting.

J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1/8" per foot, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

K. Install trap guards in accordance with manufacturers instructions.

L. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

M. Fasten recessed-type plumbing specialties to reinforcement built into walls.

N. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

O. Install individual shutoff valve in each water supply to plumbing specialties. Use ball valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Section "Valves" for general-duty ball valves.

P. Install air vents at water piping high points. Include ball valve in inlet.

Q. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

R. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 LABELING AND IDENTIFYING

A. Indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section "Plumbing Identification"

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer, double-check backflow-preventer and double-check, detector-assembly according to authorities having jurisdiction and the device manufacturer's recommendations.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

A. Set field-adjustable pressure set points.

B. Set field-adjustable flow set points.

C. Set field-adjustable temperature set points.

END OF SECTION 221119

SECTION 221125 - CIRCULATING PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.3 ABBREVIATIONS

A. BAS Building Automation System

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect against damage.

C. Comply with pump manufacturer's written instructions for handling.

PART 2 - PRODUCTS

2.1 CIRCULATING PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Corporation.
3. Grundfos Pumps Corp.
4. TACO Incorporated.

B. Description: Factory-assembled and -tested, in-line, wet rotor or system lubricated, close-coupled, 100% lead free, overhung-impeller, designed for circulating domestic hot water.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Motor: Non-overloading at all points on the pump curve
3. Casing: Bronze, with companion-flange connections.
4. Impeller: Plastic.
5. Motor: Single speed, unless otherwise indicated.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

2.3 CONTROLS

A. BAS: Electric, adjustable for control of water-supply pump.

1. Type: Start/Stop
2. Operation of Pump: Refer to Section "Sequence of Operation".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

B. Verify installation and location of automatic flow control valve(s). Record actual location(s) on as-built drawings.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, centrifugal pumps with shaft horizontal unless otherwise indicated.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps.

D. Install suction and discharge piping.

E. Install indicated valves &devices.

F. Comply with Division 26 Sections for electrical connections.

G. Connect controls.

H. Interlock pump with water heater to deactivate water heater when pump is deactivated..

3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Check operation of controls for automatic starting and stopping operation of pumps.

5. Perform the following startup checks for each pump before starting:
   a. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
   b. Verify that pump is rotating in the correct direction.
6. Prime pump.
7. Close discharge valve.
8. Start motor.
9. Open discharge valve slowly.
10. Adjust temperature settings on thermostatic mixing valves if included in design.
11. Adjust balancing valves if required by thermostatic mixing valve manufacturer.
12. Check and record pressure on inlet and outlet of pump.

END OF SECTION 221125

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. The following are industry abbreviations for plastic and rubber piping materials:

1. EPDM: Ethylene-propylene-diene terpolymer.
2. LEED: Leadership in Energy and Environmental Design
3. NBR: Acrylonitrile-butadiene rubber.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.
6. TPE: Thermoplastic elastomer.
7. USGBC: United States Green Building Council

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Submittal:

1. Product Data for USGBC LEED Credit EQ 4.1: For solvent cements and adhesive primers, include printed statement of VOC content.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

2.2 CAST-IRON SOIL PIPING

A. All cast iron soil pipe and fittings shall be marked with the Collective Trademark of the Cast Iron Soil Pipe Institute or NewAge Casting.

B. Pipe and Fittings: ASTM A 888 or CISPI 301.

C. Hub-and-Spigot Gaskets: ASTM C 564, rubber.

D. Hub-less Couplings:

1. All hub-less couplings shall bear the NSF trademark.

2. General: CISPI 310 and ASTM C 1277 assembly of stainless steel corrugated shield, stainless steel bands and fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.

1) Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM C 1540, Type 304, stainless-steel shield; stainless-steel bands; and ASTM C 564, rubber sleeve.

a) NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.
b) NPS 5 to NPS 10: 4-inch- wide shield with 6 bands.

b. Heavy-Duty, Cast-Iron Couplings: ASTM A 48/A 48M, 2-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.

2.3 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

B. Solvent Cement and Adhesive Primer:

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Aboveground, Soil, Waste, and Vent Piping located inside plenum: Hub-less cast-iron soil piping with heavy duty couplings.

C. Underground, Soil, Waste, and Vent Piping:

2. Service Weight Hub and Spigot cast iron soil pipe and fittings.

3. Epoxy coated Service Weight Hub and Spigot cast iron soil pipe and fittings.

4. Other than kitchen waste: PVC pipe and fittings.

3.2 PIPING INSTALLATION

A. Refer to Section "Facility Sanitary Sewers" for Project-site sanitary sewer piping.

B. Refer to Section "Common Work Results for Plumbing" for basic installation.

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

E. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping

upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the minimum slopes required by authorities having jurisdiction.

K. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Refer to section "Common Work Results for Plumbing" for basic piping joint construction.

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hub-less cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hub-less-coupling joints.

D. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

A. Refer to Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices in zones other than A & B.

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. 1 ½" and 2": 60" with 3/8"rod.
2. 3": 60" with ½"rod.
3. 4" and NPS 5: 60" with 5/8" rod.
4. 6": 60" with ¾" rod.
5. 8" to 12": 60" with 7/8" rod.
6. 15": 60" with 1" rod.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. 1 ½" and 2": 48" with 3/8" rod.
2. 3": 48" with ½" rod.
3. 4" and 5": 48" with 5/8" rod.
4. 6": 48" with ¾" rod.
5. 8" to 12": 48" with 7/8" rod.

I. Install supports for vertical PVC piping every 48".

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Where required or indicated prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.8 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 ABBREVIATIONS

A. RPZ Reduced Pressure Zone

B. FOG Fats, oils, and greases.

1.3 DEFINITIONS

A. Withstand: Units shall remain in place without separation of any parts when subjected to seismic forces indicated. "Essential facility" units shall be fully operational after the seismic event.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, and accessories:

B. Shop Drawings:

C. Operation and Maintenance Data: To include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. General:

1. Available Manufacturers:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification
2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Closure Material: Match pipe, brass, PVC, or ABS

B. Floor Cleanouts:

1. Housing: threaded, adjustable.
2. Type: Threaded, adjustable housing.
3. Body: Cast iron.
4. Outlet Connection: Inside calk, Spigot, or Threaded.
5. Adjustable Housing Material: Cast iron with threads.
6. Frame and Cover Material and Finish: Satin finish nikaloy.
7. Frame and Cover Shape: Round or Square (Contractors Option).
8. Top Loading Classification: Extra Heavy Duty.
9. Riser: ASTM A 74, Service weight, cast-iron drainage pipe fitting and riser to cleanout.
10. Carpet Ring: Yes for carpeted floors.
11. Tile Recess: Yes for tiled floors.
12. Terrazzo: Yes for terrazzo floors

C. Wall Cleanouts:

1. Wall access: Yes
2. Body: Match connected piping.
3. Closure: Countersunk or raised-head, drilled-and-threaded plug.
4. Closure Plug Size: Same as cleanout size but not larger than four inches in diameter.
5. Wall Access: Round, flat, chrome-plated brass, nickel-bronze, copper-alloy, or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Zurn Plumbing Products Group; Light Commercial Operation.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3
3. Pattern: As indicated.
4. Clamping Flange: Required.

2.3 TRENCH DRAINS

A. Trench Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3 for trench drains.
3. Material: Ductile or gray iron.
4. Clamping Flange: Required.
5. Top Loading Classification: Extra Heavy-Duty.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Plastic Stack Fitting (For Use Where Plastic Stacks Are Indicated): ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating (For Use Where Plastic Laboratory Stacks are Indicated: Corrosion resistant on interior of fittings.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. PPP
   b. Josam

c. Smith
d. Zurn

2. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
3. Size: Same as floor drain inlet.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

2.6 MOTORS

A. General requirements for motors are specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts.

D. Install cleanout deck plates with top flush with finished floor.

E. For wall cleanouts located in concealed piping, install cleanout access covers, with cover tight to finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains as indicated. If indication is not clear, position for easy access and maintenance.
2. Set floor drains at elevations indicated.
3. Install floor-drain flashing flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain.

G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

H. Install through-penetration firestop assemblies in plastic conductors and stacks at rated penetrations.

I. Install floor-drain, trap-seal primer fittings on inlet to floor drains indicated to receive trap-seal primer.

J. Install air-gap fittings on RPZ backflow preventers and where indicated.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, and refer to Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Checks and Inspections:

1. Leak Check: After installation, charge system and check for leaks. Repair leaks and recheck until no leaks exist.

3.5 PROTECTION

A. Protect drains during construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of open pipes at end of each day or when work stops.

END OF SECTION 221319

SECTION 221413 – FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. LEED: Leadership in Energy and Environmental Design

B. PE: Polyethylene plastic.

C. USGBC: United States Green Building Council

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with a minimum working-pressure rating of 10-foot head of water.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of the testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. All cast iron soil pipe and fittings shall be marked with the Collective Trademark of the Cast Iron Soil Pipe Institute or NewAge Casting.

B. Pipe and Fittings: ASTM A 74, Service class.

C. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. All cast iron soil pipe and fittings shall be marked with the Collective Trademark of the Cast Iron Soil Pipe Institute.

B. Pipe and Fittings: ASTM A 888 or CISPI 301.

C. Hub-less Couplings:

1. All hub-less couplings shall bear the NSF trademark.

2. General: CISPI 310 and ASTM C 1277 assembly of stainless steel corrugated shield, stainless steel bands and fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.

1) Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM C 1540, Type 304, stainless-steel shield; stainless-steel bands; and ASTM C 564, rubber sleeve.

a) NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.
b) NPS 5 to NPS 10: 4-inch- wide shield with 6 bands.

b. Heavy-Duty, Cast-Iron Couplings: ASTM A 48/A 48M, 2-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

B. Solvent Cement and Adhesive Primer:
1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Above ground Storm Drainage Piping: Unless indicated otherwise use any of the following piping materials for each size range:
   1. 2" to 4": Service class, cast-iron soil piping; gaskets; and gasketed joints.
   2. 2" to 4": Hub-less, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.
      b. Couplings: Heavy-duty, cast iron.
   3. 5" and 6": Service class, cast-iron soil piping; gaskets; and gasketed joints.
   4. 5" and 6": Hubless, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.
      b. Couplings: Heavy-duty, cast iron.
   5. 8" and Larger: Service class, cast-iron soil piping; gaskets; and gasketed joints.
   6. 8" and Larger: Hubless, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.
      b. Couplings: Heavy-duty, cast iron.

C. Underground Storm Drainage Piping: Use any of the following piping materials for each size range:
   1. 2" to 4": Service class, cast-iron soil piping; gaskets; and gasketed joints.
   2. 2" to 4": Hub-less, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.
      b. Couplings: Heavy-duty, cast iron.
   3. 2" & Larger: Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
   4. 5" and 6": Service class, cast-iron soil piping; gaskets; and gasketed joints.
   5. 5" and 6": Hub-less, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.
      b. Couplings: Heavy-duty, cast iron.
   6. NPS 8and Larger: Service class, cast-iron soil piping; gaskets; and gasketed joints.
   7. NPS 8 and Larger: Hubless, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.
      b. Couplings: Heavy-duty, cast iron.

3.3 PIPING INSTALLATION

A. Refer to Section " Storm Utility Drainage Piping" for Project site storm sewer and drainage piping.

B. Refer to Section "Common Work Results for Plumbing" for basic piping installation.

C. Refer to Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices in zones other than A & B.

D. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Section "Storm Drainage Piping Specialties".

E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

F. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

K. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

L. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

M. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Refer to Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

D. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backlog.

1. Horizontal Piping: Horizontal backwater valves.
2. Install backwater valves in accessible locations.
3. Refer to Section "Storm Drainage Piping Specialties" for backwater valves.

3.6 HANGER AND SUPPORT INSTALLATION

A. Refer to Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices in zones other than A & B.

B. Refer to Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices. Install the following:
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. 1 ½" and 2": 60" with 3/8" rod.
2. 3": 60" with ½" rod.
3. 4" and 5": 60" with 5/8" rod.
4. 6": 60" with ¾" rod.
5. 8" to 12": 60" with 7/8" rod.
6. 15": 60" inches with 1" rod.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   5. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221413

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 ABBREVIATIONS

A. AFF Above Finished Floor.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 ROOF DRAINS

A. General-Purpose Roof Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    a. Josam Company.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe.
    d. Watts Water Technologies, Inc.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.4, for general-purpose roof drains.
3. Body Material: Cast iron.
4. Combination Flashing Ring and Gravel Stop: Required.
5. Underdeck Clamp: Required.
6. Sump Receiver Plate: Not required.
7. Dome Material: Aluminum.
8. Extension collar required.

B. Cornice, Sill, and Gutter Roof Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Josam Company.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe.
    d. Watts Water Technologies, Inc.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for cornice and gutter roof drains.
3. Body Material: Metal.
4. Dimension of Body: Nominal 6-inch diameter.
5. Dome Material: Bronze.

C. Parapet Roof Drains:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Josam Company.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe.
    d. Watts Water Technologies, Inc.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for parapet roof drains.
3. Body Material: Cast iron.
4. Grate Material: Bronze.

2.2 OVERFLOW ROOF DRAINS

A. General-Purpose Overflow Roof Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Josam Company.
    b. Smith, Jay R. Mfg. Co.
    c. Watts Water Technologies, Inc.
    d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for general-purpose roof drains.
3. Body Material: Cast iron.
4. Combination Flashing Ring and Gravel Stop: Required.
5. Underdeck Clamp: Required.
6. Sump Receiver Plate: Not required.
7. Dome Material: Aluminum.

2.3 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES.

A. Storm Drain and Storm Drain Overflow Nozzles:
1. Available manufacturers

a. JR Smith Manufacturing
b. Josam Company
c. Zurn

2. Description: Stainless Steel body with threaded inlet and integral wall flange with mounting holes.
3. Size: Same as connected conductor
4. Basis of design : Josam Series 25010-Q100.
5. Product is for use where storm drain piping or secondary storm drain piping exits the building above grade and shall be provided where indicated on the drawings.

2.4 CLEANOUTS

A. General:

1. Available Manufacturers:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Closure Material: Match pipe, brass, PVC, or ABS

B. Floor Cleanouts:

1. Housing: threaded, adjustable.
2. Type: Threaded, adjustable housing.
3. Body: Cast iron.
4. Outlet Connection: Inside calk, Spigot, or Threaded.
5. Adjustable Housing Material: Cast iron with threads.
6. Frame and Cover Material and Finish: Satin finish nikaloy.
7. Frame and Cover Shape: Round or Square (Contractors Option).
8. Top Loading Classification: Extra Heavy Duty.
9. Riser: ASTM A 74, Service weight, cast-iron drainage pipe fitting and riser to cleanout.
10. Carpet Ring: Yes for carpeted floors.
11. Tile Recess: Yes for tiled floors.
12. Terrazzo: Yes for terrazzo floors

C. Wall Cleanouts:

1. Wall access: Yes
2. Body: Match connected piping.
3. Closure: Countersunk or raised-head, drilled-and-threaded plug.
4. Closure Plug Size: Same as cleanout size but not larger than four inches in diameter.
5. Wall Access: Round, flat, chrome-plated brass, nickel-bronze, copper-alloy, or stainless-steel cover plate with screw.

2.5 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Plastic Stack Fitting (For Use Where Plastic Stacks Are Indicated): ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains where indicated. Create low points in roof areas according to roof membrane manufacturer's written installation instructions. Install flashing ring, collar, or flange to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.

B. Install downspout boots at grade. Secure to building wall.

C. Install storm drain and storm drain overflow nozzles at exposed bottom of storm drain and storm drain overflow conductors where they spill onto grade.

D. Install cleanouts in aboveground piping and building drain piping according to the International Plumbing Code.

E. Install cleanouts for piping below floors.

F. Install cleanout deck plates with top flush with finished floor.

G. For wall cleanouts located in concealed piping, install cleanout wall access covers with cover tight to finished wall.

H. Install horizontal backwater valves where indicated.

I. Install concrete slabs at backwater valves.

J. Install cleanouts in vertical conductors at 18" AFF.

K. Install access door in wall if required to access cleanout.

L. Install through-penetration firestop assemblies at penetrations of rated assemblies.

3.2 CONNECTIONS.

A. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 PROTECTION

A. Protect drains during construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of open piping at end of each day or when work stops.

END OF SECTION 221423

SECTION 221429 - SUMP PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 BASIS OF DESIGN PRODUCT: As scheduled on the drawings or as otherwise indicated.

1.3 ABBREVIATIONS

A. BAS Building Automation System

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, furnished specialties and accessories. Provide wiring diagrams for power, signal, and control wiring including interface with BAS.

B. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.
   1. Operation and maintenance data for elevator sump pumps shall state that they shall be tested for proper operation as required by "FIELD QUALITY CONTROL" "Checks & Inspections" below each time the elevator inspector inspects the elevator or every 6 months whichever occurs more frequently.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

C. ANSI Compliance: Comply with ANSI/HI: 1.4 for installation of centrifugal pumps.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 ELEVATOR SUMP PUMP

A. Submersible Sump Pumps:

1. Manufacturers:

a. Grundfos Pumps Corp.
b. Stancor, Inc.
c. Weil Pump Company, Inc.
d. Zoeller Company.

2. Description: Factory-assembled and -tested sump-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Cast iron. Must handle up to ½" diameter spherical solid.
6. Shaft: Stainless steel or steel.
7. Seal: Mechanical.
8. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection.
9. Lifting eye or lug: Required
10. Power/sensor cable: Length as required to reach junction box in elevator pit. Neatly rout cables and group together using self extinguishing black UVB resistant 0.1" wide nylon zip ties.

B. Controls:

C. Available Manufacturers:
1. Stancor
2. Oil Smart Technologies

D. Hardware:
1. Switch Type: Float switch.
2. Oil Sensor: Required
3. Probe Material: Stainless Steel.
4. Power/sensor cable: 25 feet minimum, 25 foot increments up to 250 feet in length, waterproof. Route in conduit and make connection to control box mounted in elevator equipment room and Junction box adjacent to pump.

E. Control Interface With BAS: Auxiliary contacts in pump controls for interface to BAS. Provide alarm status.

2.2 SUMP-PUMP BASINS AND BASIN COVERS

A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.

1. Material: Cast iron, fiberglass, or reinforced concrete.
2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab to prevent sump from floating.

B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings for access to pumps, controls, discharge piping, vent connections, valves, and power cables. Provide steel or cast iron reinforcement capable of supporting foot traffic.

1. Cover Material: Cast iron.
2. Cover Diameter: Minimum 20".
3. Manhole Required: Yes
4. Vent Size: As indicated.

2.3 MOTORS

A. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of piping connections prior to sump pump installation.

3.2 INSTALLATION

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

B. Elevator Sump Pumps:

1. Install system in accordance with manufacturer's written instructions.
2. Provide empty conduit between elevator sump and panel under Division 26. Size shall be as required by system manufacturer to pull control cable through conduit.
3. Pipe the sump pump discharge to location indicated.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

A. Checks and Inspections:

1. Perform visual inspection of each sump pump.
2. Operational Check: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Check and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Leak check: During operational test while sump pump is running, check piping, valves and piping accessories for leaks. Repair leaks and recheck until no leaks exist.
5. Elevator Sump Pump Additional Check:
    a. With pump active place 20 gallons of water into sump and allow pump to run until it is stopped by controls.
    b. Deactivate the pump by using the disconnect switch if installed, or turning off at the control panel.
    c. Add 20 gallons of water to the sump. This will be over and above any water remaining in the sump after the controls stopped the pump.
    d. Start the pump and ensure it stops automatically within thirty (30) seconds. Intent is to indicate the pump assembly pumps a minimum of forty (40) gallons per minute.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to complete installation and startup checks according to manufacturer's written instructions.

3.6 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 221429

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 BASIS OF DESIGN PRODUCT

A. As scheduled on the drawings or as otherwise indicated.

1.3 SUBMITTALS

A. Product Data: For each type and size of domestic-water heater proposed. Include rated capacities, operating characteristics, electrical characteristics, furnished specialties and accessories.

B. LEED Submittal: Product Data for Prerequisite EA 2: Documentation indicating that units comply with ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."

C. Wiring Diagrams: For power, signal, and control wiring.

D. Product Certificates: For each type of gas-fired, tank-less, domestic-water heater, from manufacturer.

E. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

F. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

G. Warranty: Sample of warranty.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA 90.1 Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period from date of Substantial Completion:

   a. Gas-Fired, Tank-less, Domestic-Water Heaters:

      1) Heat Exchanger: Five years.
      2) Controls and Other Components: Three years.

PART 2 - PRODUCTS

2.1 DOMESTIC-WATER HEATERS

1. General:
   a. The basis of design for each water heater shall be as indicated. The contractor shall provide equivalent products by one of the listed manufacturers.

2. Manufacturers:
   a. Navien
   b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   c. Rinnai

2.2 GAS-FIRED, TANK-LESS, DOMESTIC-WATER HEATERS

A. Standard: ANSI Z21.10.3/CSA 4.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.

B. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.

1. Tappings: ASME B1.20.1 pipe thread.
2. Pressure Rating: 150 psig
3. Heat Exchanger: Copper tubing.
4. Insulation: Comply with ASHRAE/IESNA 90.1.
5. Jacket: Metal, with enameled finish, or plastic.
6. Burner: For use with tank-less, domestic-water heaters and natural-gas fuel.
7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
8. Temperature Control: Adjustable thermostat.

C. Support: Bracket for wall mounting.

D. Capacity and Characteristics: Refer to Plumbing drawings and schedules.

1. Minimum Vent Diameter: Refer to and coordinate with manufacturer's written installation recommendations and Mechanical drawings and schedules.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. The basis of design for each Compression Tank shall be as indicated. The contractor shall provide an equivalent product.

B. Domestic-Water Compression Tanks:

1. Available Manufacturers:

a. AMTROL Inc.
b. Honeywell International Inc.
c. Pentair Pump Group (The); Myers.
d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
e. State Industries.
f. Taco, Inc.
g. Hubbell

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

C. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than ¾" with ASME B1.20.1 pipe threads.

D. Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2 Heat-Trap Fitting.

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include rating to match gas supply & water heater requirement.

G. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank. ANSI Z21.22/CSA 4.4-M or ASME rated and stamped.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

I. Plug and cord:
1. Where water heaters require 120 volt single phase power, provide a plug and cord, for connection to a standard grounded outlet.
2. Cord length: As required to reach outlet, 6'-0" maximum.
3. Plug and cord ampacity shall be approved by the water heater manufacturer.

J. Intake Venting:
1. Air Intake Termination: PVC gooseneck elbow with bird screen.
2. CPVC/PVC as recommended by water heater manufacturer.

2.4 SOURCE QUALITY CONTROL

A. Run/fire water heaters prior to shipment.

B. Hydrostatically test water heaters and storage tanks to minimum of one and one-half times pressure rating prior to shipment.

C. Domestic-water heaters will be considered defective if they leak or do not operate correctly. Comply with requirements in Section "Quality Requirements" for re-testing and re-inspecting requirements and Section "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Tank-less, Domestic-Water Heater Mounting: Install wall-mounted, tank-less, domestic-water heaters at least 18 inches above floor on wall bracket. Install floor-mounted, tank-less, domestic-water heaters on housekeeping pad.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section "General Duty Valves for Plumbing Piping".

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 221113 "Facility Natural-Gas Piping."

D. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping full size and same as domestic-water piping material in continuous downward pitch, and discharge by positive air gap onto closest floor drain.]

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install heat traps on inlet and outlet piping.

I. Fill with water.

J. Charge compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 221113 "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section "Quality Requirements" for retesting and reinspecting requirements and Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train. Train Owner's maintenance personnel to adjust, operate, and maintain water heaters.

END OF SECTION 223400

SECTION 224200 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Water closets.
2. Urinals.
3. Lavatories.
4. Private sinks.
5. Kitchen sinks.
6. Service basins
7. Water coolers/Bottle filling stations.
8. Wall boxes, Hydrants & Hose reels.

B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
3. Division 22 Section "Security Plumbing Fixtures."
4. Division 22 Section "Emergency Plumbing Fixtures."

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

D. FRP: Fiberglass-reinforced plastic.

E. PMMA: Polymethyl methacrylate (acrylic) plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

E. Performance Submittals:

1. Manufacturers' data for each type of plumbing fixture indicating flow and flush rates.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.

2. Vitreous-China Fixtures: ASME A112.19.2M.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Manual-Operation Flushometers: ASSE 1037.
4. Brass Waste Fittings: ASME A112.18.2.
5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Floor Drains: ASME A112.6.3.
2. Grab Bars: ASTM F 446.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Off-Floor Fixture Supports: ASME A112.6.1M.
5. Pipe Threads: ASME B1.20.1.
6. Plastic Toilet Seats: ANSI Z124.5.
7. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 2 of each type.

4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
5. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.
6. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 WATER CLOSETS

A. WATER CLOSET – WALL HUNG (ACCESSIBLE) (**WC-1**) WITH MANUAL FLUSH VALVE:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kohler No. K-4325 (1.28 Gallon Flush)

   a. Material: Vitreous china

   b. Color: White

   c. Valve: Sloan Model Royal 111.128 (1.28 Gal. Flush)
      1) General: Exposed piston type chrome plated flushometer.
      2) Supply Rough-in Elevation: 11-1/2" above spud connection
      3) Accessible handle located on wide side of approach.
      4) Sweat solder adapter and cast wall flange with set screw.

   d. Fixture Carrier: Select Josam, Smith or other manufacturer's fixture carrier to suit installation in terms of clear space available in the chase, waste pipe configuration, and waste piping location.

   e. Seat: Church 9500SSCT (White)
      1) Elongated extra heavy weight seat with stainless steel self-sustaining check hinge.
      2) Open front, no cover

2. Manufacturers:
   a. Water Closet
      1) American Standard
      2) Eljer
   b. Flush Valve
      1) Delany
      2) Zurn
      3) Sloan
      4) Moen
   c. Seat
      1) Olsonite
      2) Centoco

B. WATER CLOSET - WALL HUNG (**WC-2**) WITH MANUAL FLUSH VALVE:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kohler No. K-4325 (1.28 Gallon Flush)
   a. Material: Vitreous china
   b. Color: White
   c. Valve: Sloan Model Royal 111.1 (1.28 Gal. Flush)
      1) General: Exposed piston type chrome plated flushometer.
      2) Supply Rough-in Elevation: 11-1/2" above spud connection
      3) Accessible handle located on wide side of approach.
      4) Sweat solder adapter and cast wall flange with set screw.

   d. Fixture Carrier: Select Josam, Smith or other manufacturer's fixture carrier to suit installation in terms of clear space available in the chase, waste pipe configuration, and waste piping location.

   e. Seat: Church 9500SSCT (White)
      1) Elongated extra heavy weight seat with stainless steel self-sustaining check hinge.
      2) Open front, no cover

2. Manufacturers:
   a. Water Closet
      1) American Standard
      2) Eljer
   b. Flush Valve
      1) Delany
      2) Zurn
      3) Sloan
      4) Moen
   c. Seat
      1) Olsonite
      2) Centoco

2.2 URINALS

A. URINAL – **(UR-1)** (ACCESSIBLE) WITH MANUAL FLUSH VALVE

1. Manufacturer & Model Number: Kohler No. K-4991-ETSS (0.125 Gallon Flush)
2. Material: Vitreous china
3. Color: White
4. Flush Valve: Sloan Model 186-0.125 ESS-DBP-BN-TMO-HW (0.125 Gallon Flush)
   a. Supply Rough-in Elevation: 11-1/2" above spud connection
   b. Accessible handle located on wide side of approach.
   c. Sweat Solder Adapter and Cast Wall Flange with Set Screw.
   d. Vandal Resistant Stop Cap with Set Screw.
5. Carrier: Josam Series 17560-UR.
   a. Options
      1) Provide components for thicker walls when required.
      2) Provide valve plate for attaching to upright.
6. Other Manufacturers: Provide products, features, and accessories equal to those specified above.

a. Urinal
   1) American Standard
   2) Eljer
   3) Crane
   4) Gerber
b. Flush Valve
   1) Delany
   2) Moen
   3) Zurn
   4) Sloan

2.3 LAVATORIES

A. LAV STATION – SINGLE BASIN (**LA-1**) (ACCESSIBLE)) WITH BATTERY POWERED SENSOR FAUCET

1. Manufacturer & Model Number: Bradley TLX-1
   a. Size: 26-1/4"x 20-5/8"
   b. Built in air dam
   c. Core per manufacturer recommendations.
   d. Stainless steel front access panel
   e. Wall mounted carrier
2. Material: Brushed nickel finishes
3. Color: As selected by Architect
4. Faucet: Bradley S53-3300 – Brushed Nickel
   a. Dual sensor activation
   b. Filtered Solenoid valve w/ serviceable "Y" Strainer
   c. Splash Proof Circuit control Module
   d. Spray Pattern: Multi-Laminar
   e. Below deck thermostatic Mixing valve
   f. 0.5 GPM vandal resistant spray head.
   g. Sensor Range adjustment screw.
   h. BakCheck tee for hot and cold water supply
   i. Low battery LED indicator.
   j. (4) AA Alkaline batteries.
   k. (4) Extra AA Alkaline Batteries in un-opened container.
5. Trap: McGuire Part Number 8902C-F
   1) 1-1/4"x 1-1/2" cast brass polished chrome trap with cleanout plug and brass slip nuts.
   2) 17-gauge seamless tubular chrome plated brass wall bend.
   3) Forged brass chrome plated wall flange with setscrew.
6. Supplies: McGuire Part Number 2165-N3-F
   1) ½" IPS x 3/8" OD
   2) ½" x 3" chrome plated brass nipple.
   3) Heavy brass chrome plated wall flange with set-screw
   4) Contractor shall coordinate supply connection to faucet.
7. Other Manufacturers: Provide products, features, and accessories equal to those specified above.
   1) Lavatory
      a) Bradley

b) Acorn
c) American Standard

2) Faucet:
a) Bradley
b) Sloan
c) Zurn

3) Trap:
a) Kohler
b) Cambridge Brass

4) Supplies:
a) Cambridge Brass
b) Kohler

5) Insulation
a) McGuire

6) Carrier
a) JR Smith

B. LAV STATION – DOUBLE BASIN (**LA-2**) (ACCESSIBLE)) WITH BATTERY POWERED SENSOR FAUCETS

1. Manufacturer & Model Number: Bradley TLX-2
   a. Size: 55-5/16"x20-5/8"
   b. Built in air dam
   c. Core per manufacturer recommendations.
   d. Stainless steel front access panel
   e. Wall mounted carrier
2. Material: Brushed Nickel finishes
3. Color: As selected by Architect
4. Faucet (2 of) Bradley S53-3300
   a. Dual sensor activation
   b. Filtered Solenoid valve w/ serviceable "Y" Strainer
   c. Splash Proof Circuit control Module
   d. Spray Pattern: Multi-Laminar
   e. Below deck thermostatic Mixing valve
   f. 0.5 GPM vandal resistant spray head.
   g. Sensor Range adjustment screw.
   h. BakCheck tee for hot and cold water supply
   i. Low battery LED indicator.
   j. (4) AA Alkaline batteries.
   k. (4) Extra AA Alkaline Batteries in un-opened container.
5. Traps: <u>McGuire Part Number 8902C-F</u>
   1) 1-1/4"x 1-1/2" cast brass polished chrome trap with cleanout plug and brass slip nuts.
   2) 17-gauge seamless tubular chrome plated brass wall bend.
   3) Forged brass chrome plated wall flange with setscrew.
6. Supplies: <u>McGuire Part Number 2165-N3-F</u>
   1) ½" IPS x 3/8" OD
   2) ½" x 3" chrome plated brass nipple.
   3) Heavy brass chrome plated wall flange with set-screw
   4) Contractor shall coordinate supply connection to faucet.

7. Other Manufacturers: Provide products, features, and accessories equal to those specified above.
    1) Lavatory
        a) Bradley
        b) Acorn
    2) Faucet:
        a) Kohler
    3) Trap:
        a) Kohler
        b) Cambridge Brass
    4) Supplies:
        a) Cambridge Brass
        b) Kohler
    5) Insulation
        a) McGuire
    6) Carrier
        a) JR Smith

C. LAV STATION – TRIPLE BASIN – (**LA-3**) (ACCESSIBLE) WITH BATTERY POWERED SENSOR FAUCETS

1. Manufacturer & Model Number: Bradley TLX-3
    a. Size: 85-1/4" x 20-5/8"
    b. Built in air dam
    c. Core per manufacturer recommendations.
    d. Stainless steel front access panel
    e. Wall mounted carrier
2. Material: Brushed Nickel finish
3. Color: As selected by Architect
4. Faucets (3 of) Bradley S53-3300
    a. Dual sensor activation
    b. Filtered Solenoid valve w/ serviceable "Y" Strainer
    c. Splash Proof Circuit control Module
    d. Spray Pattern: Multi-Laminar
    e. Below deck thermostatic Mixing valve
    f. 0.5 GPM vandal resistant spray head.
    g. Sensor Range adjustment screw.
    h. BakCheck tee for hot and cold water supply
    i. Low battery LED indicator.
    j. (4) AA Alkaline batteries.
    k. (4) Extra AA Alkaline Batteries in un-opened container.
5. Traps: <u>McGuire Part Number 8902C-F</u>
    1) 1-1/4"x 1-1/2" cast brass polished chrome trap with cleanout plug and brass slip nuts.
    2) 17-gauge seamless tubular chrome plated brass wall bend.
    3) Forged brass chrome plated wall flange with setscrew.
6. Supplies: <u>McGuire Part Number 2165-N3-F</u>
    1) ½" IPS x 3/8" OD
    2) ½" x 3" chrome plated brass nipple.
    3) Heavy brass chrome plated wall flange with set-screw

4) Contractor shall coordinate supply connection to faucet.

7. Other Manufacturers: Provide products, features, and accessories equal to those specified above.
   1) Lavatory
      a) Bradley
      b) Acorn
   2) Faucet:
      a) Kohler
   3) Trap:
      a) Kohler
      b) Cambridge Brass
   4) Supplies:
      a) Cambridge Brass
      b) Kohler
   5) Insulation
      a) McGuire
   6) Carrier
      a) JR Smith

D. LAVATORY – (**LA-4**) (ACCESSIBLE)) UNDERMOUNT WITH MANUAL FAUCET

1. Manufacturer & Model Number: Kohler Brazn K-21058
   a. Size: 21"x16"
   b. Core per manufacturer recommendations.
2. Material: Vitreous China
3. Color: White
4. Faucet: Kohler K-28126-4K
   a. Spray Pattern: Multi-Laminar
   b. Single handle
   c. 1 GPM max flow rate.
   d. BakCheck tee for hot and cold water supply
   e. Include drain with overflow
5. Trap: McGuire Part Number 8902C-F
   1) 1-1/4"x 1-1/2" cast brass polished chrome trap with cleanout plug and brass slip nuts.
   2) 17-gauge seamless tubular chrome plated brass wall bend.
   3) Forged brass chrome plated wall flange with setscrew.
6. Supplies: McGuire Part Number 2165-N3-F
   1) ½" IPS x 3/8" OD
   2) ½" x 3" chrome plated brass nipple.
   3) Heavy brass chrome plated wall flange with set-screw
   4) Contractor shall coordinate supply connection to faucet.
7. Other Manufacturers: Provide products, features, and accessories equal to those specified above.
   1) Lavatory
      a) Bradley
      b) Acorn
   2) Faucet:
      a) Kohler
   3) Trap:

a) Kohler
b) Cambridge Brass

4) Supplies:
a) Cambridge Brass
b) Kohler

5) Insulation
a) McGuire

2.4 SINKS

A. SINK (**SK-1**) (ACCESSIBLE)

1. Manufacturer & Model Number: Elkay LRADQ-2219
   a. Overall Length (left to right):22.00"
   b. Overall Width (front to back): 19.50"
   c. Inside Bowl Depth: 5.5"
   d. Material: 18 Gauge Stainless Steel
   e. Number of Bowls: 1
   f. Drain location: Off-center, rear.
   g. Mounting: Inside hole ratchet system equal to Elkay Quick-Clip® mounting system. Systems requiring access from below shall not be permitted.
   h. Deck Hole drilling configuration:
      1) 3 holes, 4"apart, centered.
2. Faucet: Chicago 1100-317VPABCP
   a. Hole configuration: 3 Hole installation, 4" centers.
   b. Spout: 8" long swing spout.
   c. Handles: 4" wristblade.
   d. Aerator: Vandal resistant, pressure compensating, 2.2 gpm
   e. Cartridges: Ceramic or compression ¼ turn.
   f. Meets ADA requirements: Yes
   g. Other:
      1) Red & blue temperature indicators. Red = Hot, blue = cold.
3. Basket Strainer & Tail Piece: McGuire Part Number 151
   a. Material: Forged brass, chrome plated.
   b. Tailpiece: 1-1/2" x 4" 20 gauge seamless brass, chrome plated.
   c. Nuts: Cast brass lock, slip, and coupling, chrome plated
4. Trap: McGuire Part Number 8912-C-F
   a. Size:1-1/2"x 1-1/2"
   b. Material: Polished chrome plated cast brass.
   c. Cleanout plug: Yes
   d. Nuts: Polished chrome plated brass.
   e. Wall bend: 17-gauge seamless tubular chrome plated brass.
   f. Wall flange: Chrome plated brass with setscrew. Where pipe protrudes from wall contractor may provide deep flange.
5. Supplies: McGuire Part Number 2167-N3-F
   a. Inlet: ½" IPS
   b. Outlet: ½" OD compression.
   c. Nipple: ½" x 3" chrome plated brass.
   d. Wall flange: Heavy brass chrome plated with set-screw

6. Insulation: Tru-Bro Lav Guard #102
   a. Insulate P-trap, hot and cold angle valves, hot and cold risers.
7. Other Manufacturers: Provide products, features, and accessories equal to those specified above.
   a. Sink
      1) Kohler
      2) Just
      3) Eagle Group
   b. Faucet:
      1) Chicago
      2) T&S
      3) Speakman
   c. Basket Strainer & Tail Piece:
      1) Kohler
      2) Cambridge Brass
   d. Trap:
      1) Kohler
      2) Cambridge Brass
   e. Supplies:
      1) Chicago
      2) Cambridge Brass
      3) T&S

B. BAR SINK – (**SK-2**) UNDERMOUNT MANUAL FAUCET

1. Manufacturer & Model Number: Kohler K-6589-U
   a. Overall Length (left to right):15.00"
   b. Overall Width (front to back): 12-3/8"
   c. Inside Bowl Depth: 7"
   d. Material: 18 Gauge Stainless Steel
   e. Number of Bowls: 1
   f. Drain location: Off-center, rear.
   g. Mounting: Inside hole ratchet system equal to Elkay Quick-Clip® mounting system. Systems requiring access from below shall not be permitted.
   h. Deck Hole drilling configuration:
      1) 1 hole
2. Faucet: Kohler K-30472
   a. Hole configuration: 1 Hole installation
   b. Spout: 8" long swing spout.
   c. Handles: 4" wristblade.
   d. Aerator: Vandal resistant, pressure compensating, 1.5 gpm
   e. Cartridges: Ceramic or compression ¼ turn.
   f. Meets ADA requirements: Yes
   g. Other:
      1) Red & blue temperature indicators. Red = Hot, blue = cold.
3. Basket Strainer & Tail Piece: McGuire Part Number 151
   a. Material: Forged brass, chrome plated.
   b. Tailpiece: 1-1/2" x 4" 20 gauge seamless brass, chrome plated.
   c. Nuts: Cast brass lock, slip, and coupling, chrome plated
4. Trap: McGuire Part Number 8912-C-F

a. Size:1-1/2"x 1-1/2"
b. Material: Polished chrome plated cast brass.
c. Cleanout plug: Yes
d. Nuts: Polished chrome plated brass.
e. Wall bend: 17-gauge seamless tubular chrome plated brass.
f. Wall flange: Chrome plated brass with setscrew. Where pipe protrudes from wall contractor may provide deep flange.

5. Supplies: McGuire Part Number 2167-N3-F
   a. Inlet: ½" IPS
   b. Outlet: ½" OD compression.
   c. Nipple: ½" x 3" chrome plated brass.
   d. Wall flange: Heavy brass chrome plated with set-screw
6. Insulation: Tru-Bro Lav Guard #102
   a. Insulate P-trap, hot and cold angle valves, hot and cold risers.
7. Other Manufacturers: Provide products, features, and accessories equal to those specified above.
   a. Sink
      1) Kohler
      2) Just
      3) Eagle Group
   b. Faucet:
      1) Chicago
      2) T&S
      3) Speakman
   c. Basket Strainer & Tail Piece:
      1) Kohler
      2) Cambridge Brass
   d. Trap:
      1) Kohler
      2) Cambridge Brass
   e. Supplies:
      1) Chicago
      2) Cambridge Brass
      3) T&S

2.5 WATER COOLERS

A. BI-LEVEL WATER COOLER/BOTTLE FILLING STATION – (**EWC-1**) (ACCESSIBLE)

1. Manufacturer & Model Number: Elkay Model LZSTL8WSLP
   a. Self-contained wall hung electric refrigerated water cooler/bottle filling station.
   b. 8 GPH at 50 degrees F.
   c. Vandal resistant bubbler
   d. Push bar activation on front, left, & right of unit.
   e. Built-in flow regulator
   f. Connect to water supply using dielectric coupling.
   g. Polyester elastomer flexible bubbler.
   h. Provide non-metallic strainer.
   i. Provide quick connect fittings.

j. Provide cane apron on upper fountain.
k. Material: Stainless steel.
l. Color: Manufacturer's standard.
m. Electrical: 115V, 1 PH, 60 HZ, 4.0 Full load amps, 370 Watts.

2. Supply: McGuire Part Number 2165-N3-F
   a. ½" IPS x 3/8" OD
   b. ½" x 3" chrome plated brass nipple.
   c. Heavy brass chrome plated wall flange with set-screw
   d. Provide dielectric connection.
   e. Wheel handle.
3. Provide 1½"diameter plastic tailpiece extension. Electrically isolate cooler from drainage and vent system.
4. Trap: McGuire Part Number 8912-C-F
   a. Size:1-1/2"x 1-1/2"
   b. Material: Polished chrome plated cast brass.
   c. Cleanout plug: Yes
   d. Nuts: Polished chrome plated brass.
   e. Wall bend: 17-gauge seamless tubular chrome plated brass.
   f. Wall flange: Chrome plated brass with setscrew. Where drain pipe connection protrudes from wall contractor may provide deep flange.
5. Other Manufacturers: Provide products, features, and accessories equal to those specified above.
   a. Drinking Fountain:
      1) Acorn Aqua
      2) Haws Corp
      3) Oasis
   b. Trap:
      1) Kohler
      2) Cambridge Brass

2.6 SERVICE BASIN

A. SERVICE MOP BASIN – (**MB-1**) (32"X32")

1. Manufacturer & Model Number: Stern-Williams Serviceptor Model SB-702
   a. Shoulders shall not be less than 9" high inside measurement, and not less than 1" wide. The tiling flange shall be cast integral to the unit and shall extend 1" above the shoulder on 2 sides. Basin shall be composed of marble chips and Portland cement ground smooth and sealed to resist stains. A one piece, 20 gauge, type 302 stainless steel stainless steel cap shall be integrally cast into the unit on four sides.
      1) Dimensions: 32"x 32"x 12".
      2) Cap: Stainless steel on 4 sides.
      3) Tiling Flange: Yes on two sides.
      4) Material: Terrazzo
      5) Color: Manufacturer's standard
2. Faucet: Moen Model 8232
   a. 8" center
   b. Vacuum breaker spout
   c. Lever Handles

d. Integral supply check-stops
e. Pail hook
f. Wall support

3. Drain: Cast brass with stainless steel strainer or equal as furnished with sink.
4. Trap: 3" (Provide additional pipe and material transition as required make connection to sink)
5. Stainless utility shelf with mop/broom holders and rag hooks: Bobrick Model B-239
6. Provide the following other accessories:
   a. Hose hook
   b. 36" long hose
7. Other Manufacturers: Provide products, features, and accessories equal to those specified above.
   a. Service Sink
      1) Fiat
      2) Just
      3) Florestone
   b. Faucet:
      1) T&S
      2) Chicago
      3) Speakman

2.7 WALL HYDRANT – (**WH-1**)

A. Manufacturer & Model Number: Josam Hydrasan 71000 non-freeze w/box.

B. General: Cast bronze, non-freeze, wall hydrant with cast bronze box, satin finish face, hinged latching cover, control key,and integral vacuum breaker/backflow preventer. Pressure rating shall be 125 psig. C (860 kPa)omply with ASME A112.21.3M, ASSE 1011, and ASSE 1019. Provide self-draining integral non-removable hose-connection, and wall clamp.

1. Inlet: (DN 20 or DN 25)¾" threaded or solder joint.
2. Outlet: ASME B1.20.7, garden-hose threads.
3. Operating Keys: One with each hydrant.

C. Other Manufacturers:

1. Smith
2. Woodford
3. Zurn

2.8 SUPPLY OUTLET BOX

A. ICE MAKER OUTLET BOX – (**WSB-1**)

1. Manufacturer: Oatey
2. General: Recessed-mounting, 20 gauge steel, outlet box& faceplate with supply fitting complying with ASME A112.18.1M. Include box with faceplate, supply valve, and reinforcement
3. Supply valve: ½" IPS (or copper sweat) x 3/8" OD
4. Available Manufacturers

a. Guy Gray
b. Water-tite
c. LSP Products Group.

B. COFFEE OUTLET BOX – (**WSB-2**)

1. Manufacturer: Oatey
2. General: Recessed-mounting, 20 gauge steel, outlet box& faceplate with supply fitting complying with ASME A112.18.1M. Include box with faceplate, supply valve, and reinforcement
3. Supply valve: ½" IPS (or copper sweat) x 3/8" OD
4. Available Manufacturers
   a. Guy Gray
   b. Water-tite
   c. LSP Products Group.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

L. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

M. Install toilet seats on water closets.

N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

P. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install shower flow-control fittings with specified maximum flow rates in shower arms.

R. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

S. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

T. Set service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

U. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

SECTION 224500 - EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following emergency plumbing fixtures:

1. Eye/face wash equipment.

B. Related Sections include the following:

1. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.
2. Division 22 Section "Sanitary Waste Piping Specialties" for floor drains.

1.3 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Tepid: Moderately warm.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" ; and Public Law 101-336, "Americans with Disabilities Act" ; for plumbing fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

A. EMERGENCY SHOWER WITH EYE/FACE WASH - ACCESSIBLE **(EEWS-1)**:
1. Manufacturer & Model Number: Bradley model S19-312B
2. Combination drench shower and eye/face wash unit
3. Shower valve operates by a pull rod with a triangular handle.
4. Shower provides a superior washdown with a more even spray pattern.
5. Eye/Face operated by a large, highly visible push handle.
6. Eyewash bowl – 10-3/4" diameter corrosion-resistant stainless steel.
7. Complies with American National Standard Z358.1

B. Emergency Mixing Valve: Bradley model S19-2200 (EFX60)
1. Adjustable set point with temperature range
2. Accurate temperature control to within +/- 3 degree F.
3. Positive shutoff of hot supply when cold supply is lost
4. Adjustable high temperature stop limits temperature to 90 degrees F.
5. Equipped with integral checkstops on hot and cold supply.
6. Flow Range = 3 GPM at less than 5 PSID – 64 GPM at 45 PSID
7. Provide recessed cabinet – 18 gauge body and door
8. Dirt and lime resistant
9. Factory assembled and tested.
10. Install valve in 1ST floor ceiling space near fixture.

C. Other Manufacturers: Provide products, features, and accessories equal to those specified above.
1) Haws Corp
2) Encon
3) Guardian

2.2 SOURCE QUALITY CONTROL

A. Certify performance of plumbed emergency plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

1. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 22 Section "Common Work Results for Plumbing."

F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 22 Section "Meters and Gages for Plumbing Piping."

G. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.

H. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Division 22 Section "Sanitary Waste and Vent Piping."

I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

J. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties..

B. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.

C. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.

D. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.

E. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.

3.4 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

C. Report test results in writing.

3.5 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 224500

SECTION 224600 - SECURITY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following security plumbing fixtures and related components:

1. Combination units.
2. Fixture supports for front-mounting, stainless-steel fixtures and wall-mounting fixtures.

B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Plumbing Fixtures."

1.3 DEFINITIONS

A. Accessible Fixture: Security plumbing fixture that can be approached and used by people with disabilities.

B. Back-Mounting-Type Fixture: Security plumbing fixture designed to mount on wall sleeve built into wall so installation and removal of fixture and piping and other components are only accessible from service space behind wall.

C. Front-Mounting-Type Fixture: Security plumbing fixture designed to mount on fixture support with installation and removal from fixture side of wall, and piping and other components are accessible from access panels in fixture or wall.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include furnished specialties and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For security plumbing fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" ; and Public Law 101-336, "Americans with Disabilities Act" ; about security plumbing fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

D. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer Valves: Equal to 10 percent of amount installed for each type indicated, but no fewer than 2 units.
2. Mechanical and Air-Operated Valves: Equal to 15 percent of amount installed for each type indicated, but no fewer than 3 units.

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

A. Security Combination Units - Accessible, **(PWA-1)**:

Basis-of-Design Product:

1. Provide Willoughby Series 4896 Ligature-resistant combination unit, Handicap-ADA compliant, back-mounting, rear access, security water closet/lavatory; fabricated from 14 gauge thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.

2. Water Closet/Lavatory:

   a. Unit:

      1) Left or Right hand configuration. See plans
      2) ECW - Wall outlet
      3) WS - Wall sleeve (omit for Steel Cell wall)
      4) PBH – Ligature resistant pneumatic push buttons
      5) BC - Code bubbler/filler (w/mouth guard)
      6) PC3 - Pinned cleanout plug
      7) OV – Lavatory overflow
      8) PML2 - Dual temp pneumatic metering lavatory valve
      9) T4A - Toilet overflow preventer with auto reset
      10) RTH - Recessed tissue holder
      11) TWE - 3" PVC toilet waste extension connection
      12) TWC3P – 3" PVC toilet waste coupling
      13) LWE - 1 ½" PVC lavatory waste extension connection
      14) HPS – High polish seat
      15) Toilet shipping cover

   b. Flush Valve: Willoughby/Sloan Flush Valve (1.28 Gal. Flush)

   c. Refer to plans for orientation.

      1) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support entire fixture. Include steel bars or other design that will prevent escape if fixture is removed. (omit for Steel Cell wall)

3. Joint Sealant:

   a. Place security (Dynaflex or equal, slightly flexible) caulk around the entire fixture interface as it touches either the floor or wall.

4. Other Manufacturers:

   a. Fixture:

      1) Acorn
      2) Bradley
      3) Metcraft

   b. Flush Valve:

      1) Sloan
      2) Zurn

B. Security Combination Units, **(PWA-2)**:

Basis-of-Design Product:

1. Description: Provide Willoughby Series 1546 combination unit, back-mounting, rear access, security water closet/lavatory; fabricated from 14 gauge thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.

2. Water Closet/Lavatory:
   a. Unit:
      1) PWA-2: Center configuration
      2) ECW - Wall outlet
      3) WS - Wall sleeve (omit for Steel Cell wall)
      4) PBH – Ligature resistant pneumatic push buttons
      5) BC - Code bubbler/filler (w/mouth guard)
      6) PC3 - Pinned cleanout plug
      7) OV – Lavatory overflow
      8) PML2 - Dual temp pneumatic metering lavatory valve
      9) T4A - Toilet overflow preventer with auto reset
      10) RTH - Recessed tissue holder
      11) TWE - 3" PVC toilet waste extension connection
      12) TWC3P – 3" PVC toilet waste coupling
      13) LWE - 1 ½" PVC lavatory waste extension connection
      14) HPS – High polish seat
      15) Toilet shipping cover
   b. Flush Valve: Willoughby/Sloan Flush Valve (1.28 Gal. Flush)
   c. Refer to plans for orientation.

3. Wall Sleeve: Galvanized-steel frame of dimensions required to match and support entire fixture. Include steel bars or other design that will prevent escape if fixture is removed. (omit for Steel Cell wall)

4. Joint Sealant:
   a. Place security (Dynaflex or equal, slightly flexible) caulk around the entire fixture interface as it touches either the floor or wall.

5. Other Manufacturers:
   a. Fixture:
      1) Acorn
      2) Bradley
      3) Metcraft
   b. Flush Valve:
      1) Sloan
      2) Zurn

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before security plumbing fixture installation.

B. Examine floors and walls for suitable conditions where security plumbing fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SECURITY PLUMBING FIXTURE INSTALLATION

A. Install back-mounting-type, stainless-steel security plumbing fixtures as follows:

1. Install wall sleeve in wall.
2. Install fixture on wall sleeve; mount components on or attached to wall sleeve with access from accessible service space.
3. Extend supply piping from service space to fixture.
4. Install soil and waste piping from fixture and extend into service space.
5. Install fixture trap in service space instead of below fixture drain.

B. Install front-mounting-type, stainless-steel security plumbing fixtures as follows:

1. Install fixture support or mounting bracket.
2. Install fixture on support; mount components inside of or attached to fixture.
3. Extend supply piping from pipe space to fixture.
4. Install trap below fixture and extend soil and waste piping into pipe space.

C. Install security plumbing fixture outlets with gasket seals.

D. Install fixtures designated "accessible" according to ICC A117.1 for heights, dimensions, and clearances.

E. Install fixtures level and plumb.

F. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

G. Install dielectric fittings in water-supply piping to fixtures if piping and fixture connections are made of different metals. See Division 22 Section "Common Work Results for Plumbing" for dielectric fittings.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect hot- and cold-water supply piping to security plumbing fixtures. Include supply stops, if specified, or ball valve on each supply. Ball valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

C. Connect soil and waste piping to security plumbing fixtures.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Testing: After installing security plumbing fixtures and after electrical circuitry has been energized, test for compliance with requirements.
2. Remove and replace malfunctioning security plumbing fixtures. Retest as specified above after repairs or replacements are made.

3.5 ADJUSTING

A. Operate and adjust water-supply flushometers and flow-control valves on security plumbing fixtures.

3.6 CLEANING

A. Clean security plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall spouts and strainers.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed security plumbing fixtures and fittings.

B. Do not allow use of security plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224600

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.4 QUALITY ASSURANCE

A. Equipment and appliances comprising portions of the mechanical systems regulated by the applicable building codes shall be listed and labeled in accordance with the current edition of those codes.

B. Equipment and appliances comprising portions of the mechanical systems shall be installed in accordance with the listing, manufacturer's installation instructions, and the applicable building codes. Manufacturer's installation instructions shall be available on the job site for use and inspection.

C. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

D. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

E. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.6 INTENT OF CONTRACT DOCUMENTS

A. Mechanical and HVAC drawings are diagrammatic, indicating general locations and arrangements of pipe, duct, and equipment. Not necessarily indicating all offsets, conditions, and appurtenances required to provide clearances for maximum practical accessibility to perform maintenance.

B. Coordinate work in order to achieve proper operation and to provide a maintainable installed condition.

C. Notify the Architect's representative immediately of conditions which do not comply or will not produce this result.

D. Indicated configurations were used to size pipes, fans, pumps, expansion tanks and other devices. Install piping, duct, and equipment generally as indicated. Minor deviations are permitted in the course of necessary coordination. Major changes shall be submitted for

approval by the Architect's representative. Additional fittings and offsets not indicated are expected, anticipated by the design, and shall be provided. If more than 5% of the indicated number of fittings are required or if one change in direction is within six inches of another change in direction and this "Z" shape is not indicated notify the Architect's representative immediately. Provide necessary additional fittings and offsets. Changes in pipe size shall be made only with written approval from the Architect's representative.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to Section "Hydronic Piping" for additional pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 23 piping sections for joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions inside & outside pipe and:

1. ASME B16.21, non-metallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is otherwise indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated, and full-face or ring type, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free (95% Tin, 5% Antimony) alloy. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MECHANICAL GROOVED JOINT COUPLINGS

A. Manufacturer: Victaulic

B. Description: Pipe joint consisting of a grooved pipe, EPDM gasket, steel housing, 2 bolts and 2 nuts.

C. Gasket Material: Grade "E" EPDM suitable for use up to 250°F.

D. Housing: Carbon steel

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Available Manufacturers:

   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Watts Industries, Inc.; Water Products Div.

D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225°F.

1. Available Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PE: Reusable, PE, tapered cup-shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.8 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and non-metallic, dry hydraulic cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, non-corrosive, non-gaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.9 SECURITY FASTENERS:

A. Description: Accessories, anchorage inserts, and security fasteners providing a complete tamperproof installation.

B. Exposed Security Fasteners:
1. Fastener: Provide **torx-head** (star with center reject pin) security fasteners for anchoring work in exposed security areas.
2. Finish: Finish shall match that specified of the item anchored.
3. Tools: Provide tools for fastening devices.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following and Division 23 Sections specifying piping systems.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated.

D. Install piping above accessible ceilings allowing sufficient space for ceiling panel removal.

E. Install piping to permit valve operation & servicing.

F. Install condensate drain piping at 1% slope.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections unless otherwise indicated.

I. Install piping leaving room for installation of insulation.

J. Install system components with pressure rating equal to or greater than system operating pressure.

K. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Exposed, Interior Installations/Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
2. Exposed, Interior Installations/Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish and set-screw.
3. Exposed, Interior Installations/Insulated Piping: One-piece, cast-brass type with polished chrome-plated finish.
4. Exposed, Interior Installations/Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with finish to match surrounding surfaces.
5. Exposed, Interior Installations/Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with finish to match surrounding surfaces.
6. Exposed, Interior Installations/Piping in Unfinished Service Spaces: None, provide sealant.
7. Exposed, Interior Installations/Piping in Equipment Rooms: None, provide sealant.
8. Exposed, Interior Installations/Piping at Floor Penetrations in Equipment Rooms, Fan Rooms, or similar wet spaces: None - provide sealant and sleeve extending 2" above floor to prevent liquid leaking to floor below.

L. Provide seal around piping penetrations of full height interior walls, both rated and non-rated, that occur above ceilings. Refer to Section 079200 Joint Sealants.

M. Sleeves are not required for core-drilled holes.
   1. Exception: Exposed, Interior Installations at Floor Penetrations in Equipment Rooms, Fan Rooms, or similar wet spaces.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.
   1. Exception: Exposed, Interior Installations at Floor Penetrations in Equipment Rooms, Fan Rooms, or similar wet spaces.

O. Install sleeves for pipes passing through walls, floors, or roofs.

   1. Cut sleeves to length for mounting flush with both surfaces.

      a. Exception: Extend sleeves installed in floors of mechanical equipment rooms, fan rooms or other similar wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring.

   2. Install sleeves as walls and slabs are constructed.

      a. PVC Pipe Sleeves: Permitted for pipes smaller than 6" except aboveground, exterior-walls.
      b. Steel Sheet Sleeves: Permitted for pipes 6" and larger, penetrating gypsum-board partitions except aboveground, exterior-walls.
      c. Seal space outside sleeve fittings with grout and sealant.

   3. Except for penetrations where mechanical sleeve seals are used, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Section "Joint Sealants".

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for annular clear space required by the mechanical sleeve seal manufacturer between pipe and sleeve for installing mechanical sleeve seals.

   1. Install steel pipe for sleeves smaller than 6 inches in diameter.
   2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
   3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
   4. Sleeves from an approved sleeve seal manufacturer shall be acceptable.

Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for annular clear space required by the mechanical sleeve seal manufacturer between pipe and sleeve for installing mechanical sleeve seals.

R. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply water-flushable flux, unless otherwise indicated, to tube end. Construct joints using lead-free solder alloy.

E. Brazed Joints: Construct joints using copper-phosphorus brazing filler metal.

F. Threaded Joints: Thread pipe with tapered pipe threads. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless otherwise indicated.

G. Welded Joints: Construct joints using qualified processes and welding operators.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Mechanical Joints: Prepare pipe ends and fittings, apply coupling, and join according to joint manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2" and smaller, one adjacent to each valve and at final connections to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2" and larger, adjacent to final connections to each piece of equipment.
3. Install dielectric unions or flanges for connections of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to service side of equipment.

D. Install equipment to allow space for other systems.

3.5 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 HOUSEKEEPING PADS AND EQUIPMENT PADS

A. Housekeeping pads and equipment pads: Anchor equipment to concrete according to equipment manufacturer's written instructions and according to seismic codes at project location.

1. Construct concrete pads in accordance with drawing details.
2. Details may be found on structural drawings. If details are not provided comply with the following:
    a. Housekeeping pads inside the building shall be 6" thick and 6" larger all around than supported equipment. Provide #4 rebar at 12" on center each way at mid-depth of slab. Provide a 3/4" chamfer on all edges.
    b. Equipment pads outside the building shall be 8" thick with a 12" deep and 20" wide turndown (footing) all around the outside edge of the pad. Provide #5 rebar at 16" on center each way at mid-depth of slab. Pad shall be 6" larger all around than supported equipment.
    c. Install dowel rods to connect housekeeping pad to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the pad. Provide a 1" chamfer on all edges.
    d. Install epoxy-coated anchor bolts. For equipment on housekeeping pads bolts shall extend through housekeeping pad, and anchor into structural concrete floor.
    e. Place and secure anchor bolts using supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions for placement.
    f. Install anchor bolts to elevations required for proper attachment to supported equipment.
    g. Install anchor bolts according to anchor bolt manufacturer's written instructions.
    h. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section "Cast-in-Place Concrete".

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.9 SECURITY FASTENERS

A. All fasteners exposed in security areas shall be security fasteners. Where standard fasteners on manufactured devices and equipment are accessible, they shall be replaced with security fasteners.

3.10 EXCAVATION AND BACKFILL

A. Excavation and backfill shall be as indicated in Division 1 specifications and on the drawings. If excavation and backfill is not otherwise indicated the following shall apply:
   1. Excavate trenches to indicated gradients, lines, depths, and elevations.
      a. Beyond the building perimeter, excavate trenches to allow installation of top of pipe below frost line.
   2. Excavate trenches to uniform widths to provide twelve inches clear on each side of pipe. Excavate trench walls vertically from trench bottom.
   3. Trench Bottoms: Excavate trench bottoms to provide flat surface. Place and compact six inches of sand. Excavate and shape sand to provide uniform bearing and support of pipes. Shape sand to provide continuous support for bells, joints, fittings, and barrels of pipes. Sand shall be free of projecting stones and sharp objects.

4. Backfill and hand tamp to 95% proctor to six inches above the top of the pipe.
5. Backfill and machine tamp the remainder of the trench to 95% proctor in twelve inch lifts.

END OF SECTION 230500

SECTION 230513 – MOTORS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Manufacturer's catalog and efficiency data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.4 COORDINATION

A. All motors are required to be equipped with overload protection located near the motor.

1. Overload protection shall:

   a. Be located between the circuit breaker or fuse provided under Division 26 and the motor windings.
   b. Meet one of the options specified in the following paragraph.

2. Overload protection may be:

   a. Located in the motor installed by the motor manufacturer. (preferred)
   b. A separate device located near the motor.
   c. Located in, or with, a disconnect switch provided by the equipment manufacturer. Provision of this switch shall not modify, change, or eliminate any Division 26 requirement. This means some equipment shall be provided or specified with two disconnecting means.

B. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:

1. Compatible with controller
2. Matched to torque and horsepower requirements of the load.
3. Matched to ratings and characteristics of supply circuit and required control sequence.

C. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

D. Belt tension must be wrench and socket adjustable.

E. Belt tensioning device must accommodate adjustable sheaves.

PART 2 - PRODUCTS

2.1 MOTOR REQUIREMENTS

A. Motor requirements apply except as follows:

1. Ratings, performance, or characteristics for a motor are specified in another Section or are scheduled on the drawings.

2. Motor manufacturer requires ratings, performance, or characteristics, other than those specified to meet indicated performance.

2.2 MOTOR CHARACTERISTICS

A. Frequency Rating: 60 Hz.

B. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

C. Duty: Continuous at 105 deg F and 3300 feet above sea level.

D. Capacity and Torque sufficient to:

1. Start, accelerate, and operate connected load.

2. Maintain designated speeds.

3. Operate at installed altitude and environment.

4. Operate with indicated operating sequence.

5. Operate without exceeding nameplate ratings.

6. Operate without utilizing service factor.

E. Enclosure: Open drip-proof unless otherwise indicated.

F. Minimum Service Factor: 1.15 unless otherwise indicated.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. NEMA Premium efficiency motors shall meet the following full load efficiency:

HP	ODP			TEFC		
	6 Pole	4 Pole	2 Pole	6 Pole	4 Pole	2 Pole
1	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2	87.5	86.5	85.5	88.5	86.5	85.5
3	88.5	89.5	85.5	89.5	89.5	86.5
5	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7

C. Efficiency: NEMA Premium

D. Stator: Copper windings, unless otherwise indicated.

E. Rotor: Squirrel cage, unless otherwise indicated.

F. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating, unless otherwise indicated.

H. Insulation: Class F, unless otherwise indicated.

I. Code Letter Designation: NEMA starting Code F or G.

J. Enclosure: Cast iron.

K. Finsh: Gray enamel.

L. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Perform the following:

1. Run each motor with its controller at load.
2. Demonstrate correct rotation, alignment, and speed.
3. Test interlocks and control features for proper operation.
4. Verify that current in each phase is within nameplate rating.
5. Verify RPM is in accordance with nameplate.
6. Where a generator is provided, run each motor on the generator with its controller and load. Demonstrate correct rotation, alignment, and speed.

3.2 ADJUSTING

A. Align motors, bases, and shafts.

3.3 CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

END OF SECTION 230513

SECTION 230514 – VARIABLE SPEED DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Factory Installed Variable Speed Drive: A drive installed by motorized-equipment manufacturer as a component of equipment utilized to control the speed of a motor.

B. Field-Installed Variable Speed Drive: A drive installed in the field by the contractor to control the speed of a motor not equipped with a factory installed drive.

C. VSD: Variable Speed Drive

1.3 SUBMITTALS

A. Submittals shall include the following information:
   1. Outline dimensions
   2. Conduit entry locations
   3. Weight.

B. Customer connection and power wiring diagrams.

C. Technical product description including but not limited to a complete list of options.

D. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).

E. The VFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. All VFD's shall include a minimum of 5% impedance reactors.

1.4 QUALITY ASSURANCE

A. VSDs and options shall be UL listed as a complete assembly.

B. The base VSD shall be UL listed for 100 KAIC without the need for input fuses.

C. The VSD shall be tested by the manufacturer.

D. All optional features shall be functionally tested at the factory for proper operation.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. Comply with UL 508C.

F. Referenced standards:
1. Standard 519-1992, IEEE Guide for Harmonic Content and Control.
2. UL508C
3. ICS 7.0, AC Adjustable Speed Drives
4. IEC 16800 Parts 1, 2 and 3NEC 430.120, Adjustable-Speed Drive Systems
5. IBC 2006 Seismic – referencing ASC 7-05 and ICC AC-156

G. All VSDs installed on this project shall be from the same manufacturer.

H. The VSD enclosure shall be seismically certified and labeled in accordance with the IBC 2006 International Building Code:
1. VSD manufacturer shall provide Seismic Certification and Installation requirements at time of submittal.
2. A Seismic importance factor of 1.5 shall be used and shall be based upon actual shake test data as defined by ICC AC-156. Seismic ratings based upon calculations alone are not acceptable.
3. Certification of Seismic rating must be based on testing done in all three axis of motion by a certified lab.

I. Installations in life safety applications including but not limited to smoke removal and make up air to smoke removal systems shall be included in the seismic approval.

1.5 COORDINATION

A. Coordinate features of VSDs with motors, installed units, and accessory devices. Provide VSDs that meet the requirements indicated in this and other equipment specific specification sections.

B. Confirm that motors controlled by VSDs, provided under this section are designed and labeled for use with variable speed drives, and suitable for use throughout speed range without overheating.

C. Coordinate VSD support with requirements for maintenance and replacement; and installation of accessories.

PART 2 - PRODUCTS

2.1 FACTORY INSTALLED VARIABLE SPEED DRIVES

A. The VSD shall be enclosed in a UL Listed enclosure.

B. Refer to equipment specific specification sections.

C. Where equipment specific specification sections do not indicate variable speed drive requirements comply with 2.2 below.

2.2 FIELD-INSTALLED VARIABLE SPEED DRIVES

A. Manufacturers

1. ABB
2. Yaskowa
3. Basis of Design - Danfoss Graham

B. General

1. Furnish complete variable speed drives (VSDs) as indicated.
2. Drawing schedules, sequences of control, control diagrams, details, or other specification sections may indicate variable speed requirements.
3. All standard and optional features shall be included within the VSD enclosure, unless indicated otherwise. Each VSD shall be housed in a NEMA 1 enclosure, or other NEMA type according to installation and operating conditions.
4. Provide NEMA 4 weatherproof enclosures for drives mounted outside.
5. The UL listing shall allow mounting in a plenum or other air handling compartment. If a NEMA 12 enclosure is required for the plenum rating, the manufacturer shall supply a NEMA 12 rated VSD.
6. Provide bypass on VSDs serving pumps. A bypass on all other equipment is not required unless indicated otherwise.

C. The VSD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current. Operation shall be suitable for centrifugal pump and fan control and shall eliminate the need for motor de-rating.

D. With the motor's rated voltage applied to the VSD input, the VSD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VSDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

E. The VSD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

F. The VSD and options shall be tested to ANSI/UL Standard 508. The complete VSD, including all specified options, shall be assembled by the manufacturer and shall be UL-508 certified for the building and drive assembly including options. Assembly of the options by a third-party

panel shop is not acceptable. The appropriate UL stickers shall be applied to both the VSD and option panel, in the case where these are not contained in one panel.

G. The VSD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VSDs without DC link reactors shall provide a minimum 3% impedance line reactor.

H. The VSD's full load amp rating shall meet or exceed NEC Table 430-150. The VSD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

I. The VSD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.

J. An automatic energy optimization selection feature shall be provided standard in the VSD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.

K. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VSD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.

L. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.

M. Galvanic and/or optical isolation shall be provided between the VSD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VSDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

N. VSD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VSD efficiencies while reducing motor noise.

O. Protective Features:
   1. Disconnect with drive fusing.
   2. A minimum of Class 20 I^2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.
   3. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VSD overtemperature and motor overtemperature. The VSD shall display all faults in plain English. Codes are not acceptable.
   4. Protect VSD from sustained power or phase loss. The VSD shall provide full rated output with an input voltage as low as 90% of the nominal. The VSD will continue to

operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, and 313 V AC for 460 volt units.

5. The VSD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
6. VSD package shall include semi-conductor rated input fuses to protect power components.
7. To prevent breakdown of the motor winding insulation, the VSD shall be designed to comply with IEC Part 34-17. Otherwise, the VSD manufacturer must ensure that inverter rated motors are supplied.
8. VSD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
9. VSD shall function normally when the keypad is removed while the VSD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
10. VSD shall catch a rotating motor operating forward or reverse up to full speed.
11. VSD shall be rated for 100,000 amp interrupting capacity (AIC).
12. VSD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VSD will identify which of the output phases is low or lost.
13. VSD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt VSDs, and 539 V AC on 460 volt VSDs.

P. Interface Features:
1. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VSD and determine the speed reference.
2. The VSD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VSD is in Auto/Remote mode.
3. The VSD shall provide potentiometer speed control. Electronic speed controls are not acceptable.
4. Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.
5. The keypads for all sizes of VSDs shall be identical and interchangeable.
6. To set up multiple VSDs, it shall be possible to upload all setup parameters to the VSD's keypad, place that keypad on all other VSDs in turn and download the setup parameters to each VSD. To facilitate setting up VSDs of various sizes, it shall be possible to download from the keypad only size independent parameters.
7. Display shall be programmable to display in 9 languages including English, Spanish and French.
8. The display shall have four lines, with 20 characters on three lines and eight large characters on one line.

9. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VSD when the keypad is removed.
10. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VSD eliminating the need for macros.
11. The VSD shall include a standard RS-485 communications port.
12. As a minimum, the following points shall be controlled and/or accessible:
    a. VSD Start/Stop
    b. Speed reference
    c. Fault diagnostics
    d. Meter points
    e. Motor power in HP
    f. Motor power in kW
    g. Motor kW-hr
    h. Motor current
    i. Motor voltage
    j. Hours run
    k. Feedback signal #1
    l. Feedback signal #2
    m. DC link voltage
    n. Thermal load on motor
    o. Thermal load on VSD
    p. Heatsink temperature
13. Four additional Form C 230 volt programmable relays shall be available for factory or field installation within the VSD.
14. LonWorks communication shall be available for factory or field installation within the VSD.
15. Two set-point control interface (PID control) shall be standard in the unit. VSD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
16. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
17. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VSDs unable to show these four displays simultaneously shall provide panel meters.
18. Sleep mode shall be provided to automatically stop the VSD when its speed drops below set "sleep" level for a specified time. The VSD shall automatically restart when the speed command exceeds the set "wake" level.
19. The sleep mode shall be functional in both follower mode and PID mode.
20. Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VSD does not start until dampers or other auxiliary equipment are in the proper state for VSD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VSD to start.

21. The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VSD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). VSD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.
22. The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (°F) for a cooling tower application.
23. VSD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
24. If the temperature of the VSD's heat sink rises to 80°C, the VSD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VSD shall automatically reduce its output frequency to the motor. As the VSD's heat sink temperature returns to normal, the VSD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
25. The VSD shall have temperature controlled cooling fans for quiet operation and minimized losses.
26. The VSD shall store in memory the last 10 faults and related operational data.
27. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
28. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VSD status.
29. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
30. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VSD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.
31. Under fire mode conditions, the VSD shall be able to be programmed to automatically default to a preset speed.

Q. Adjustments
1. VSD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VSD to the motor.
2. Sixteen preset speeds shall be provided.
3. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
4. Four current limit settings shall be provided.

5. If the VSD trips on one of the following conditions, the VSD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.
6. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
7. An automatic "on delay" may be selected from 0 to 120 seconds.

R. Service Conditions
1. Ambient temperature, -10 to 40°C (14 to 104°F).
2. 0 to 95% relative humidity, non-condensing.
3. Elevation to 3,300 feet without derating.
4. AC line voltage variation, -10 to +10% of nominal with full output.
5. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Examination
1. Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VSD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.
2. The VSD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VSD shall not be operated while the unit is covered.

B. Start-up Service
1. The manufacturer shall provide start-up commissioning of the VSD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VSD, its options and its interface wiring to the building automation system.

C. WARRANTY: The VSD shall be warranted by the manufacturer for a period of 2 Years from date of substantial completion. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VSD manufacturer.

D. CLEANING: After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

END OF SECTION 230514

SECTION 230516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Maintenance Data: For expansion joints to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PACKLESS EXPANSION JOINTS

A. Rubber, Expansion-Compensator Packless Expansion Joints:

1. Available Manufacturers:
    a. Amber/Booth Company, Inc.; a div. of Vibration Isolation Products of Texas, Inc.
    b. Flex-Hose Co., Inc.
    c. Flexicraft Industries.
    d. Mason Industries, Inc.; Mercer Rubber Co.
    e. Unaflex.
2. Material: Twin reinforced-rubber spheres with external restraining cables.
3. Minimum Pressure Rating: 150 psig at 170 deg F unless otherwise indicated.
4. End Connections for 2" and Smaller: Threaded.

B. Flexible-Hose Packless Expansion Joints:

1. Available Manufacturers:

   a. Flex-Hose Co., Inc.
   b. Flexicraft Industries.
   c. Flex Pression Ltd.
   d. Metraflex, Inc.
   e. Unisource Manufacturing, Inc.

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.

   a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.

5. Expansion Joints for Copper Tubing 2-1/2" to 4": Copper-alloy fittings with threaded end connections.

   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

6. Expansion Joints for Steel Piping 2" and Smaller: Carbon-steel fittings with threaded end connections.

   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.

7. Expansion Joints for Steel Piping 2-1/2" to 6": Carbon-steel fittings with flanged end connections.

   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

2.2 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Available Manufacturers:

   a. Adsco Manufacturing LLC.
   b. Advanced Thermal Systems, Inc.
   c. Flex-Hose Co., Inc.
   d. Flexicraft Industries.
   e. Flex-Weld, Inc.
   f. Hyspan Precision Products, Inc.
   g. Metraflex, Inc.

h. Unisource Manufacturing, Inc.

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Stud: Threaded, zinc-coated carbon steel.
b. Expansion Plug: Zinc-coated steel.
c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

C. Install rubber packless expansion joints according to FSA-NMEJ-702.

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Connect risers and branch connections to mains with a minimum of 5 (five) pipe fittings including tee in main.

B. Connect risers and branch connections to terminal units with a minimum of 4 (four) pipe fittings including tee in riser.

C. Connect mains and branch connections to terminal units with a minimum of 4 (four) pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four Insert number pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 230516

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

A. Available Manufacturers:

1. Smith, Jay R. Mfg. Co.
2. Wade
3. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Available Manufacturers:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Link Seal
4. Metraflex Company (The).
5. Pipeline Seal and Insulator, Inc.
6. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM or Nitrile rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide ¼" clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants.

E. Fire Ratings: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide ¼" clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 Section "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire Rating: Maintain indicated fire rating at pipe penetrations. Seal pipe penetrations with firestop materials.

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building unless otherwise indicated. They are not required at sanitary and storm piping exits unless otherwise indicated.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade, below Grade, Concrete Slabs-on-Grade, and Concrete Slabs above Grade:
    a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.

END OF SECTION 230517

SECTION 230519 - METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 ABBREVIATIONS

A. ° Degree or degrees.

B. AFF Above Finished Floor.

C. BAS Building Automation System

D. F Fahrenheit.

E. GPM Gallons Per Minute.

F. mA Milliamp, or Milliamps.

G. PSI Pounds per Square Inch.

H. PSIG Pounds per Square Inch Gauge.

I. V Volt, or Volts

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 THERMOMETERS

A. Available Manufacturers:
   1. Flo Fab Inc.
   2. Miljoco Corporation.

3. Palmer Wahl Instrumentation Group.
4. Tel-Tru Manufacturing Company.
5. Trerice, H. O. Co.
6. Weiss Instruments, Inc.
7. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Cast aluminum

D. Size: 9" nominal unless otherwise indicated.

E. Case Form: Adjustable angle.

F. Tube: Glass with magnifying lens and blue or red organic liquid. Mercury is not acceptable.

G. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in 2° F increments.

H. Window: Glass.

I. Stem:
1. Duct Installation: Aluminum ventilated.
2. Pipe Installation: Brass.

J. Thermowell Connector for Pipe Installation: 1¼" with ASME B1.1 threads.

K. Accuracy: Plus or minus one scale division.

L. Scale Range: Suitable for service.

2.2 DUCT THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes for attachment to air duct and made to hold thermometer stem.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Manufactured by thermometer manufacturer, pressure-tight, socket-type fitting made for insertion into piping tee.
3. Material:
   a. Copper Tubing/Piping: Brass.
   b. Steel Piping: Type 316 stainless steel
4. Type: Stepped shank unless straight or tapered shank is recommended by manufacturer.
5. Bore: Diameter required to match thermometer stem.

6. Insertion Length: Length required to match thermometer stem and to reach center of pipe.
7. Lagging Extension: Include for insulated piping and tubing.
8. Heat transfer medium: As available and recommended by manufacturer.

2.4 PRESSURE GAGES

1. Available Manufacturers:
   a. Ernst Flow Industries.
   b. Flo Fab Inc.
   c. Palmer Wahl Instrumentation Group.
   d. Tel-Tru Manufacturing Company.
   e. Trerice, H. O. Co.
   f. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   g. Weiss Instruments, Inc.

2. Application Standard: ASME B40.100.
3. Case: Dry, field liquid fillable, satin finished, type 304 stainless steel, stem mounted, flangeless.
4. Pressure-Element Assembly: Bronze tube.
5. Pressure Connection: Brass, with ¼"or ½" ASME B1.20.1 pipe threads and bottom-outlet unless back-outlet is indicated.
6. Movement: Stainless steel.
7. Dial Size: 4-1/2"
8. Dial Face: Nonreflective aluminum with permanently etched black scale markings graduated in psi. Two PSI maximum per graduation.
9. Pointer: Adjustable black metal.
10. Window: Glass.
11. Ring: 304 stainless steel.
12. Accuracy: Grade 1A, plus or minus 1 percent of full scale.
13. Units: PSI
14. Scale range: Suitable for service

2.5 GAGE ATTACHMENTS

A. Pulsation Dampener: ASME B40.100, brass; with ¼" or ½", ASME B1.20.1 pipe threads and piston type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass for copper, and stainless steel for steel, pipe filled with water with ¼" or ½" pipe threads to prevent live steam from entering gauge. Provide on all gauges serving steam systems.

C. Valves: Brass needle for copper pipe, or stainless-steel needle for steel pipe, with ¼" or ½", ASME B1.20.1 pipe threads.

2.6 TEMPERATURE/PRESSURE PLUG

A. Available Manufacturers:

1. Flow Design, Inc.
2. Trerice, H. O. Co.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. Weiss Instruments, Inc.

B. Description: Test fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: ½", ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200° F.

F. Core Inserts: EPDM self-sealing rubber.

2.7 TEMPERATURE/PRESSURE PLUG KITS

A. Available Manufacturers:
1. Flow Design, Inc.
2. Trerice, H. O. Co.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. Weiss Instruments, Inc.

B. Provide one temperature/pressure plug kit containing two thermometers, one pressure gauge, pressure gauge adapter, and carrying case. Thermometer sensing elements, pressure gauge, and gauge adapter probes shall be of a diameter to fit temperature/pressure plugs and of length to project into piping.

C. Low Range Thermometer: Small, bimetallic insertion type with 1" to 2" diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125° F.

D. High Range Thermometer: Small, bimetallic insertion type with 1" to 2" diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220° F.

E. Pressure Gage: Small, Bourdon-tube insertion type with 2" to 3" diameter dial and probe. Dial range shall be at least 0 to 200 PSIG.

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.8 FLOWMETERS

A. Venturi (Variable Area) Flowmeters:

1. Available Manufacturers:
   a. ABB; Instrumentation and Analytical.
   b. Gerand Engineering Co.
   c. Hyspan Precision Products, Inc.
   d. Preso Meters; a division of Racine Federated Inc.
   e. S. A. Armstrong Limited; Armstrong Pumps Inc.

2. Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, fittings, valves, indicator, and conversion chart with 0 to 10 V or 0 to 20 mA output to BAS.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Venturi-type, calibrated, flow-measuring element; for installation in piping.

   a. Design: Differential-pressure-type measurement.
   b. Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
   c. Minimum Pressure Rating: 250 PSIG
   d. Minimum Temperature Rating: 250° F.
   e. End Connections:
      1) 2" and Smaller: Threaded.
      2) 2-1/2" and Larger: Flanged or welded.
   f. Flow Range: Flow-measuring element and flow transmitter shall cover operating range of equipment or system served.

5. Transmitter: Manufactured by same company as sensing element.

6. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having a 6"diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.

   a. Scale: GPM.
   b. Accuracy: Plus or minus 1% between 20 and 80 percent of scale range.

7. Display: Rate of flow in GPM.
8. Conversion Chart: Flow rate data compatible with sensor and measured DP.
9. Operating Instructions: Include complete instructions with each flowmeter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Thermowells:
   1. In all locations install so thermometer will be easily visible.
   2. In horizontal piping install with socket extending to center of pipe and in vertical position in piping tees.
   3. In vertical piping install with socket extending to center of pipe and in horizontal position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors.

C. Install thermowells with lagging extension on insulated piping.

D. Fill thermowells with heat-transfer medium as recommended by manufacturer.

E. Install thermometers in thermowells and adjust vertical and tilted positions so they are with-in 15' (Measured from 6' above the floor) of an easily accessible location and the window is perpendicular to that location.
   1. Exception: Where installed in piping or ductwork located in excess of 20' AFF.

F. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

G. Install thermometers in the following locations:
   1. Where indicated
   2. Inlet and outlet of each hydronic zone.
   3. Inlet and outlet of each hydronic boiler.
   4. Inlet(s) and outlet(s) of each chiller.
   5. Inlet and outlet of each hydronic coil in air-handling units.
   6. Inlet(s) and outlet(s) of each hydronic heat exchanger.
   7. Inlet and outlet of each thermal-storage tank.
   8. Outside, return, and supply air ducts.

H. Install pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install pressure gages in the following locations:

   1. Inlet an outlet of each pressure-reducing valve.
   2. Inlet and outlet of each chiller.
   3. Inlet and outlet of each boiler.
   4. Inlet and outlet of each coil.
      a. Exceptions (Install test plugs instead):
         1) Fan coil units.
         2) Variable volume terminal units.
         3) Blower coil units.
   5. Inlet of each thermal-storage tank.
   6. Suction and discharge of each pump.

J. Install valve in piping for each pressure gage.

K. Install snubber in piping for each pressure gage for fluids (except steam).

L. Install siphon fitting in piping for each pressure gage (for steam).

M. Install test plugs in piping tees where indicated and at all pipe mounted BAS pressure and temperature sensors.

N. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

O. Install flowmeter elements in accessible positions in piping systems.

P. Install flowmeter indicators on walls or brackets in accessible and readable positions.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service, maintenance, and cleaning of meters, gages, machines, and equipment.

B. Connect flowmeter elements to meters.

C. Connect flowmeter transmitters to meters.

D. Install flowmeter with straight run of pipe before and after flowmeter in accordance with manufacturer's instructions.

E. Flowmeter shall not be mounted within 10 pipe diameters of pressure independent automatic control valves.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 230519

SECTION 230523 – GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. The following are standard abbreviations for valves:
   1. CWP: Cold working pressure.
   2. EPDM: Ethylene-propylene-diene terpolymer rubber.
   3. MPTFE: Modified polytetrafluoroethylene plastic.
   4. NBR: Acrylonitrile-butadiene rubber.
   5. PTFE: Polytetrafluoroethylene plastic.
   6. RPTFE: Reinforced polytetrafluoroethylene plastic.
   7. SWP: Steam working pressure.
   8. TFE: Tetrafluoroethylene plastic.
   9. WOG: Water Oil Gas.

1.3 SUBMITTALS

A. Product Data: For each type of valve proposed. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include proposed specialties and accessories.

1.4 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
   1. Exceptions: Domestic hot- and cold-water valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

4. Set butterfly valves closed or slightly open.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze & Brass: Shall be dezincification resistant. (Zinc content shall be less than 15%)

C. Bronze Valves: 2" and smaller with threaded ends, unless otherwise indicated.

D. Ferrous Valves: 2-1/2" and larger with flanged ends, unless otherwise indicated.

E. Valve Pressure and Temperature Ratings: Not less than indicated for system pressure and temperature.

F. Valve Sizes: Same as the larger of the upstream or downstream pipe, unless otherwise indicated.

G. Valve Actuators:
1. As indicated in other Part 2 articles.
2. Where indicated, provide a chain actuator.
3. Chain Actuator: For attachment to valves of size and mounting height indicated.
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

H. Extended Valve Stems: Provide on insulated valves.

I. Valve Flanges: Provide ASME B16.1 for cast-iron valves, ASME B16.5 for steel, and ASME B16.24 for bronze.

J. Valve Grooved Ends: AWWA C606.

K. Threaded: With threads according to ASME B1.20.1.

L. Valve Bypass and Drain Connections: MSS SP-45.

2.2 COPPER-ALLOY BALL VALVES

A. Two-Piece, Copper-Alloy Ball Valves (Full Port):
   1. Conbraco Industries-Apollo 77C series with stainless steel ball & stem (Un-insulated piping)
   2. Conbraco Industries-Apollo 77C series with stainless steel ball & stem. Provide 2 ¼" stem extension (Insulated piping)
   3. Other Manufacturers:
      a. Milwaukee
      b. Watts
      c. Nibco
   4. Handle Nut: Zinc plated steel or 300 series stainless steel.
   5. Handle: Zinc plated steel, clear chromate plastic, or vinyl coated.
   6. Threaded Pack Gland: Brass ASTM B-16 Alloy 360
   7. Packing: MPTFE or TFE
   8. Stem (Blowout Proof): ASTM A-276 type 316 stainless steel. Provide 2 ¼" stem extension for Insulated piping.
   9. Thrust Washer: MPTFE or RPTFE
   10. Ball: Full-port, ASTM A-276 Type 316 stainless steel.
   11. Seats: MPTFE or Reinforced TFE
   12. Body: Bronze ASTM B-584 for solder or threaded connection.
   13. Body End Piece: Bronze ASTM B-584 for solder or threaded connection.
   14. Rating: 150 psig saturated steam, 600 psig non-shock cold water, oil, and gas.
   15. Conform To: MSS SP-110

2.3 FERROUS-ALLOY BUTTERFLY VALVES

A. General: Butterfly valves shall provide bi-directional bubble tight dead end service without a downstream flange.

B. When installed in horizontal piping, install with the stem in the horizontal position.

C. Wafer-lug type butterfly valves:
   1. Conbraco Industries-Apollo 141(wafer)/143(lug)
   2. Other Manufacturers:
      a. Stockham
      b. Demco
      c. Nibco
   3. Shaft: ASTM A-582 Type 416 Stainless steel single piece through shaft.
   4. Collar Bushing: ASTM B-124 Brass or PTFE.
   5. Stem Seal: EPDM OR Buna-N Rubber
   6. Body Seal: EPDM Rubber
   7. Upper Bushing: CDA 122 Copper or PTFE
   8. Liner: EPDM Rubber
   9. Disc: ASTM B-148 alloy 954/955 aluminum bronze.
   10. Lower Bushing: CDA 122 copper or PTFE.
   11. Body Wafer: ASTM A-536 Ductile Iron or ASTM A-126 CL. B cast iron.
   12. Body Lug: ASTM A-536 Ductile Iron or ASTM A-126 CL. B cast iron.
   13. Ratings:

a. 2" through 12" 200 psig CWP.
14. Conform To: MSS SP-67, MSS SP-25, API-609
15. Operator:
    a. Valves up to and including 6": Lever-lock operator.
    b. Valves 8" and larger: Self locking worm gear operator equipped with adjustable stops at open and shut positions.

2.4 BRONZE CHECK VALVES

A. Bronze, Horizontal Swing Check Valves:
1. NIBCO Model 413
2. Other Manufacturers:
    a. Milwaukee
    b. Stockham
3. Bonnet: ASTM B-62 bronze.
4. Body: ASTM B-62 bronze.
5. Hinge Pin: ASTM B-140 alloy C31400 bronze, or B-134 alloy C23000 bronze.
6. Disc Hanger:
    a. Sizes ¼" thru ¾": Type 304 stainless steel.
    b. Sizes 1" and larger: ASTM B-62 bronze.
7. Hanger Nut: ASTM B-16 bronze.
8. Disc Holder: ASTM B-62 bronze.
9. Seat Disc:
    a. Water and Other Heat Transfer Fluids: ASTM B-62 bronze.
    b. Steam: TFE
10. Seat Disc Nut: ASTM B-16 or B-62 bronze.
11. Hinge Pin Plug: ASTM B-140 alloy C31600 bronze.
12. Seat Disc Washer (When Provided): ASTM B-98 alloy C65500 or B-103 bronze.
13. Rating: 125 psig SWP and 200 psig CWP.
14. Conform To: MSS SP-80

B. Bronze, Inline Spring Loaded Check Valves:
1. Conbraco Industries-Apollo 61-100 series
2. Other Manufacturers:
    a. Milwaukee
    b. Stockham
    c. Nibco
3. Body: ASTM B-584 alloy C84400 bronze.
4. Retainer/Stem: ASTM B16 brass or ASTM A-582 alloy C30300 stainless steel.
5. Ball Check: RPTFE or
6. Disc Holder 316 Stainless steel
    a. Disc:
        1) Water, Oil, Gas: Buna-N
        2) Steam: TFE
    b. Seat Screw: ASTM A-276 alloy S43000 stainless steel.
    c. Body End: ASTM B-584 alloy C84400 bronze.
    d. Rating: 125 psig SWP and 250 psig CWP.
7. Guide: ASTM B16 Brass
8. Spring: Type 316 stainless steel.

9. Rating: 125 psig SWP and 400 psig WOG.

2.5 IRON BODY CHECK VALVES

A. Iron Body, Horizontal Swing Check Valves:
   1. NIBCO Model 918-B
   2. Other Manufacturers:
      a. Milwaukee
      b. Stockham
   3. Body Bolt: ASTM A-307 steel.
   4. Bonnet: ASTM A-126 class B cast iron.
   5. Body Gasket: Synthetic Fibers.
   6. Body Nut: ASTM A-307 steel
   7. Side Plug: ASTM B-16 alloy C36000 Brass.
   8. Hanger Pin: ASTM B-16 alloy C36000 Brass.
   9. Hanger: ASTM B-584 alloy C84400 cast bronze.
   10. Disc: ASTM B-584 alloy C84400 cast bronze or ASTM A-536 ductile iron w/bronze face ring.
   11. Seat Ring: ASTM B-584 alloy C84400 cast bronze.
   12. Disc Nut: ASTM B-16 alloy C36000.
   13. Body: ASTM A-126 class B cast iron.
   14. Disc Bolt: ASTM B-16 alloy C36000 Brass.
   15. Disc Plate: ASTM A-126 class B cast iron.
   16. Disc Cage: ASTM A-126 class B cast iron.
   17. Rating: 125 psig SWP and 200 psig CWP.
   18. Conform To: MSS SP-71 Type 1.

B. Grooved-End, Ductile-Iron Spring Assisted Check Valves: Victaulic Series 716 with EPDM disc seal.

C. Spring Actuated Silent Check Valves:
   1. NIBCO Model F-910
   2. Other Manufacturers:
      a. Milwaukee
      b. Stockham
   3. Body: ASTM A48 class 35 cast iron.
   4. Seat: ASTM B-584 alloy C83600 (B) bronze.
   5. Disc: ASTM B-584 alloy C83600 bronze.
   6. Spring: Type 302 ASTM A313 stainless steel.
   7. Bushing:
      a. 6" and Smaller: ASTM B-16 brass
      b. 8" and Larger: ASTM B-584 alloy C83600 bronze.
   8. Set Screws: Type 304 ASTM A-276 stainless steel.
   9. Rating: 200 psig CWP.
   10. Conform To: MIL-V-18436F

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully- pen to fully-closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where indicated.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for ball and butterfly valves 4" and larger and more than 96 inches above finished floor. Extend chains to 60 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
   3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final testing and balancing. Replace valves if persistent leaking occurs.

3.4 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball or butterfly valves.

2. Throttling Service: Ball or butterfly valves.
3. Pump Discharge: Spring-loaded, lift-disc check valves and ball or butterfly valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Chilled-Water, Heating Hot Water, Condenser Water, and Heat Pump Loop Piping (Use the following types of valves):
1. Valves, NPS 2" and Smaller: Two-Piece, Copper-Alloy Ball Valves (Full Port).
2. Valves, NPS 2-1/2" and 3":
   a. Two-piece or three-piece, Copper-Alloy Ball Valves (Full Port).
   b. Wafer-Lug, grooved-end, or flanged butterfly valves.
3. Valves, NPS 4" and Larger: Wafer-Lug, grooved-end, or flanged butterfly valves.
4. Pump Discharge Check Valves (Horizontal or Vertical), NPS 2" and Smaller: Bronze, Inline Spring Loaded Check Valves or triple duty valve.
5. Horizontal Check Valves, NPS 2" and Smaller: Bronze, Horizontal Swing Check Valves.
6. Vertical Check Valves, NPS 2" and Smaller: Bronze, Inline Lift Check Valves.
7. Pump Discharge Check Valves (Horizontal or Vertical), NPS 2-1/2" and Larger: Grooved-End, Ductile-Iron Spring Assisted Check Valves, Spring Actuated Silent Check Valves, or triple duty valve.
8. Horizontal Check Valves, NPS 2-1/2" and Larger: Bronze, Horizontal Swing Check Valves.
9. Vertical Check Valves, NPS 2-1/2" and Larger: Grooved-End, Ductile-Iron Spring Assisted Check Valves or Spring Actuated Silent Check Valves.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design Requirement: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer where using methods other than indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test medium.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

B. Trapeze Pipe Hanger Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Assemble and provide according to manufacturer's written instructions. Center piping on channel to evenly distribute load.

2. Pipe sizes and numbers shall be in accordance with the following:

TRAPEZE PIPE HANGER TABLE

PIPE SIZE	4"	3"	2 ½"	2"	1 ½"	1 ¼"	1"	TOTAL # of PIPES
NUMBER OF PIPES PERMITTED IN ONE CHANNEL SUPPORT	**2**	0	0	0	0	0	0	**2**
	0	**2**	**2**	0	0	0	0	**4**
	0	**2**	0	**4**	0	0	0	**6**
	0	**2**	0	0	**6**	0	0	**8**
	0	0	**4**	**2**	0	0	0	**6**
	0	0	**4**	0	**2**	**2**	0	**8**

	0	0	**4**	0	0	**8**	0	**12**
	0	0	0	**6**	**2**	**2**	**2**	**12**
	0	0	0	**8**	0	**2**	0	**10**
	0	0	0	0	**14**	0	0	**14**
	0	0	0	0	0	**16**	0	**16**

Notes:

1. Piping larger than 4" in diameter is not permitted in a channel support system.
2. Channel support systems shall be limited to eight (8) pipes per channel and two (2) channels (levels) per support system.
3. Smaller pipes can be substituted for larger pipes. For example two ¾" pipes may be installed in lieu of two 1" pipes, or 2" in lieu of 3", etc.
4. Spacing shall be in accordance with requirements for the smallest supported pipe. Refer to other specification sections for spacing requirements. If spacing requirements are not indicated comply with MSS SP-69.

C. Metal Framing Systems:

1. Available Manufacturers:
   a. Anvil International; a subsidiary of Mueller Water Products Inc.
   b. Empire Industries, Inc.
   c. ERICO International Corporation.
   d. Haydon Corporation; H-Strut Division.
   e. NIBCO INC.
   f. PHD Manufacturing, Inc.
   g. PHS Industries, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Available Manufacturers:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.

4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig, ASTM C 552, Type II cellular glass with 100-psig, or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2" beyond sheet metal shield for piping operating below ambient air temperature.

2.4 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

1. Available Manufacturers:

   a. Cooper B-Line – Dura-Blok
   b. MAPA Products
   c. Mifab, Inc. – C-Port
   d. Miro Industries, Inc.
   e. OMG, Inc.
   f. PHP Systems/Design
   g. Pipe Prop
   h. Roof Top Blox
   i. Rooftop Support Systems – Eberl Iron Works, Inc.

2. Provide pipe supports for supporting gas, condensate, refrigeration lines, or hyrdronic piping on flat roof surfaces. Support shall rest on roof surface without penetrating the roof surface. Supports for condensate piping shall be adjustable vertically to ensure pipe slopes as required.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Curb Mounted Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment support made from structural carbon-steel shapes unless indicated otherwise.

1. Available Manufacturers:

a. Cooper B-Line – Dura-Blok
b. MAPA Products
c. Mifab, Inc. – C-Port
d. Miro Industries, Inc.
e. OMG, Inc.
f. PHP Systems/Design
g. Pipe Prop
h. Roof Top Blox
i. Rooftop Support Systems – Eberl Iron Works, Inc.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69, MSS SP-89, and Table above. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Provide in pipe hanger or shield for insulated piping.

E. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

F. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Provide hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Provide lateral bracing with pipe hangers and supports to prevent swaying.

J. Provide building attachments within concrete slabs or attach to structural steel. Building attachments may not used on steel joists unless otherwise indicated. Provide additional attachments at concentrated loads, including valves, flanges, and strainers, 2-1/2" and larger and at changes in direction of piping. Provide concrete inserts before concrete is placed; fasten inserts to forms and provide reinforcing bars through openings at top of inserts.

K. Load Distribution: Provide hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Provide hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.
    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Provide thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Provide MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Provide MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
4. Shield Dimensions for Pipe: Not less than the following:
    a. Pipe ¼" to 3-½": 12 inches long and 0.048 inch thick.
    b. Pipe 4": 12 inches long and 0.06 inch thick.
    c. Pipe 5" and 6": 18 inches long and 0.06 inch thick.
    d. Pipe 8" to 14": 24 inches long and 0.075 inch thick.

5. Pipes 8" and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Provide with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Provide materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Unless otherwise indicated clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Provide same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and immediately apply galvanizing-repair paint. Paint shall comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Provide hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Provide nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Provide copper-plated pipe hangers and copper attachments for copper piping and tubing.

F. Provide padded hangers for piping that is subject to scratching.

G. Provide thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated provide the following:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of stationary pipes ½" to 30".
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes 4" to 14", requiring up to 4" of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes ¾" to 14", requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes ½" to 14" if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes ½" to 4", to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes ¾" to 8".
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes ½" to 8".
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes ½" to 8".
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes ½" to 8".
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes ½" to 8".
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS ½" to 3".
12. U-Bolts (MSS Type 24): For support of heavy pipes ½" to 14".
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes 4" to 14", with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes 4" to 14", with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes 2-½" to 14" if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes 1" to 14", from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes 2-½" to 14", from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes 2" to 14" if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes 2" to 14" if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes 2" to 14"if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated provide the following:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers ¾" to 14".
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers ¾" to 14" if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated provide the following:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
6. Flat Plate, Double Nut, and Washer as Detailed on Structural Drawings: For attaching to bar joists. Method of attachment to bar joists must be approved by the structural engineer and joist manufacturer.

K. Building Attachments: Unless otherwise indicated provide the following:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Flat Plate, Double Nuts, and Washer as Detailed on Structural Drawings: For use under roof installations with bar-joist construction to attach to bottom chord of joist.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Provide one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated provide the followings:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated provide the following:

1. Restraint-Control Devices (MSS Type 47): To control pipe movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Provide powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where indicated in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development for the State of California.

D. ASCE: American Society of Civil Engineers

E. VUSBC: Virginia Uniform Statewide Building Code

1.3 RESPONSIBILITIES:

A. The manufacturer of vibration isolation systems and devices shall:

1. Determine the sizes and locations of isolators and provide equipment isolation as indicated.
2. Guarantee indicated isolation system deflections.
3. Provide installation instructions and drawings.
4. Certify correctness of installation upon completion.

B. The Contractor shall cause all vibration isolation systems, including the isolators, and flexible connectors between the isolated equipment and associated piping, ducting, and electrical work to be designed by a manufacturer experienced in this type of work.

1.4 SUBMITTALS

A. Product Data:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Wind-Restraint Details:
   a. Design Analysis: To support selection and arrangement of wind restraints. Include calculations of combined tensile and shear loads.
   b. Details: Coordinate vibration isolation details with wind-restraint details required for equipment mounted outdoors.

B. Coordination Drawings: For areas indicated at ¼" = 1'0" and where sections are cut on contract drawings, indicate coordination of HVAC piping and equipment with other systems and equipment in the vicinity, include supports and restraints.

C. Qualification Data: For testing agency.

D. Shop Drawings:

1. Vibration Isolation Base Details: Detail fabrication, including anchorages, attachments to structure, and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

2. Dimensioned Outline Drawings for Each Scheduled Piece of Equipment: Identify center of gravity.

3. Dimensioned Outline Drawings for Each Scheduled Piece of Equipment: Locate and describe mounting and anchorage provisions.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers:

1. Amber/Booth Company, Inc.

2. B-Line Systems, Inc.

3. Kinetics Noise Control.

4. Mason Industries.

5. Vibration Mountings & Controls, Inc.

B. Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

2. Durometer Rating: Minimum 30.

3. Number of Layers: 1 2 3 or 4.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Durometer Rating: Minimum 30.
2. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
3. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with wind restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to ¼" thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to ¼" thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Spring Mounts: Housed spring isolators.

1. Housing: Ductile-iron or steel housing to provide all-directional restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of ¼" travel up or down before contacting a resilient collar.

H. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

I. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

J. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

L. Pipe Riser Resilient Support : All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

M. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Available Manufacturers:

1. Amber/Booth Company, Inc.
2. Kinetics Noise Control.
3. Mason Industries.
4. Vibration Mountings & Controls, Inc.

B. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand wind forces.

C. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind forces. Lower support assembly shall

have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2" of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with wind restraint.
   a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
   b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

A. Available Manufacturers:

B. Manufacturers:

1. Amber/Booth Company, Inc.
2. Kinetics Noise Control.
3. Mason Industries.
4. Vibration Mountings & Controls, Inc.

C. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1" clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
   a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

D. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
   a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip-galvanize metal components for exterior use.
3. Bake enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and wind control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Strength of Support and Wind Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to resist loads within loading limits.

3.3 VIBRATION-CONTROL DEVICE INSTALLATION

A. Comply with requirements indicated in the Contract Documents, in codes and ordinances, by Authority Having Jurisdiction, and by Manufacturer, for installation of all devices.

3.4 FIELD QUALITY CONTROL

A. Perform tests.

B. Tests:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least two of each type and size of installed anchors and fasteners.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, fix and retest until satisfactory results are achieved then modify all installations of same type to match.

C. Prepare test reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 VIBRATION ISOLATION SCHEDULE

A. Piping and Conduit

1. All piping and conduit connected to the pumps, air handling units, or other pieces of moving equipment which are isolated from the structure by spring type vibration isolators

shall be isolated from these units by flexible pipe connectors and shall be suspended on isolation hangers to a point 20 feet away. Refer to Section "Hydronic Piping" for flexible pipe connectors.

B. Ductwork

1. Flexible connectors shall be used for ductwork connections to air handling units. Refer to Section "Metal Ducts." Ductwork shall be suspended with elastomeric hangers for a distance of 20 feet from air handling units.

C. Rooftop Units

1. Units shall include fan and motor assemblies internally isolated from the unit casing using spring isolators and flexible duct connectors.

D. Pumps

1. Anchor and grout to 6" inertia base on concrete housekeeping pad. Refer to Section "Hydronic Pumps."

E. Boilers

1. Provide elastomeric neoprene isolator pad with 1/4" deflection located on 6" high concrete equipment pad.

F. Power Ventilators

1. Provide elastomeric hangers for units suspended from structure above ceiling.

G. Fan Powered Terminal Units

1. Provide elastomeric hangers for units suspended from structure above ceiling.

END OF SECTION

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
   1. Data:
      a. Manufacturer, product name, model number, and serial number.
      b. Capacity, operating and power characteristics, and essential data.
      c. Labels of tested compliances.
   2. Location: Accessible and visible.
   3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
   1. Terminology: Match schedules as closely as possible.

2. Data:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Data: Instructions for operation of equipment and for safety procedures.
2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
3. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch-thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification.
1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.3 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.
   1. Stencil Material: Metal or fiberboard.
   2. Stencil Paint: Exterior, gloss, black, unless otherwise indicated. Paint shall be low VOC and shall meet the requirements of section 09910. Paint may be in pressurized spray-can form.
   3. Identification Paint: Exterior, in colors according to ASME A13.1, unless otherwise indicated. Paint shall be low VOC and shall meet the requirements of section 09910.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
   1. Size: Approximately 4 by 7 inches].
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
   4. Color: Yellow background with black lettering.

2.6 ACOUSTICAL CEILING GRID MARKER

A. General: Plastic tape a minimum of threeone thousandths of an inch thick (3.0 mils) with pressure-sensitive, permanent-type, self-adhesive back.

B. Width: three quarters of an inch (3/4") or 22 millimeters.

C. Letter Size: ¼" minimum or 8 millimeters.

D. Letter Color: Black

E. Tape Color: White

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
   1. Fuel-burning units, including boilers and heaters.
   2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   3. Coils, evaporators, and similar equipment.
   4. Fans, blowers, primary balancing dampers, and mixing boxes.
   5. Packaged HVAC central-station air handlers and zone-type units.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
   1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
   3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
      a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
      b. Fire department hose valves and hose stations.
      c. Meters, gages, thermometers, and similar units.
      d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
      e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
      f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
      g. Fans, blowers, primary balancing dampers, and mixing boxes.
      h. Packaged HVAC central-station and zone-type units.
      i. Tanks and pressure vessels.
      j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
      k. Fire dampers

C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the colors conforming to ASME A13.1.

2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
4. Include signs for the following general categories of equipment:
    a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    b. Fuel-burning units, including boilers and heaters.
    c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    e. Fans, blowers, primary balancing dampers, and mixing boxes.
    f. Packaged HVAC central-station and zone-type units.
    g. Tanks and pressure vessels.
    h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

E. Stenciled Equipment Sign Option: Stenciled signs may be provided instead of laminated-plastic equipment signs, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

F. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers sized to ensure a tight fit. Or:
2. Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, 1-1/2 inches wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
3. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners. Or:
4. Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers with painted, color-coded bands or rectangles complying with ASME A13.1 on each piping system.
   1. Identification Paint: Use for contrasting background.
   2. Stencil Paint: Use for pipe marking.

C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings.

3.4 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts.

B. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

C. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow, may be provided instead of laminated-plastic duct markers, at Installer's option.

D. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 ACOUSTICAL CEILING GRID MARKER INSTALLATION

A. Attach tape with indicated text to t-bar below item of equipment.

B. Attach tape to grid.

C. Prepare surface and attach tape in accordance with manufacturer' recommendations.

D. Surfaces to receive tape shall be clean and free of scale, dirt, and grease.

E. Center tape on support grid. Tape shall be visible from within space.

F. Provide with lettering at equipment located above lay-in tile ceilings including but not limited to:
   1. Valves: Text = V
   2. Air Handling Units: Text = AHU
   3. Air Removal Devices: Text = ARD
   4. Strainers: Text = S
   5. Terminal Units (VAV boxes): Text = TU
   6. Coils: Text = C
   7. Fans: Text = F
   8. Damper operators: Text = D

3.6 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.8 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

A. Clean faces of mechanical identification devices.

END OF SECTION 230553

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Outdoor duct and pipe: Duct conveying untreated outside air at ambient temperature and humidity.

B. Outdoor pipe: Pipe located outside the building insulation envelope.

C. Supply air duct: Duct conveying air on the discharge side of an air handling unit or fan which will be delivered to a space in a building through a diffuser or connection to the return duct of another unit. Ductwork on the discharge side of a 100% outside air unit is considered to be Supply air duct.

D. Return air duct: Duct conveying air from a space or plenum that will return to an air handling unit or energy transfer device. The air may be returned to the supply air duct after being conditioned, or it may be exhausted after passing through an energy transfer device. Typical examples of an energy transfer devices are plate heat exchangers, runaround coils, heat pipes, and energy wheels.

E. Exhaust air duct: Duct conveying air from a space or plenum that will be exhausted from the building without being passed through an energy transfer device.

F. Plenum: An unoccupied space or void, on the conditioned side of the building insulation and vapor barrier, being used to return conditioned air to the inlet side of a return or exhaust fan either directly or via a duct connection. An example would be a space with air handling light fixtures or openings in the ceiling used to transport air through the ceiling and then to an open duct located above the ceiling in another location.

G. Indirectly Conditioned Space: A space having no direct conditioning but, due to air movement induced by an exhaust, or return opening, is conditioned by makeup air from an adjacent space. An example would be a small toilet. Boiler rooms, fan rooms, and mechanical rooms do not qualify as indirectly conditioned spaces.

H. Inside the Building Insulation Envelope: For the purposes of this section, boiler rooms, fan rooms, and mechanical rooms are considered to be OUTSIDE the building insulation envelope.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Detail application of removable insulation covers.
2. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
3. Detail attachment and covering of heat tracing inside insulation.

4. Detail insulation application at pipe expansion joints for each type of insulation.
5. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
6. Detail removable insulation at piping specialties, equipment connections, and access panels.
7. Detail application of field-applied jackets.
8. Detail application at linkages of control devices.
9. Detail field application for each equipment type.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with type, grade, and maximum use temperature.

B. Ship Insulated Piping System Components on pallets and wood supports. Securely fasten and protect from damage. Store off the ground and cover with opaque waterproof tarp to protect materials from sunlight and rain.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation, duct Installer for duct insulation, and equipment Installer for equipment insulation.

C. Maintain clearances required for maintenance.

D. Coordinate installation and testing of heat tracing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers:

1. Mineral-Fiber Insulation:
   a. CertainTeed Manson.
   b. Johns Manville
   c. Knauf FiberGlass GmbH.
   d. Owens-Corning Fiberglas Corp.

e. Schuller International, Inc.

2. Flexible Elastomeric Thermal Insulation:
   a. Armacell, LLC
   b. Rubatex Corp.
3. Removable Insulation Covers:
   a. Advance Thermal Corp.

B. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Duct Liner: Refer to specification section "Metal Ducts"

H. Mineral-Fiber Board: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, with factory applied FSK Jacket. Meet the requirements of ASTM C 1290, Type III, inorganic glass fibers bonded by a thermosetting resin to maximum service temperature of 250°F.. Faced insulation shall not exceed 25 Flame Spread, 50 Smoke Developed when tested in accordance with ASTM E84.

I. Semi-Rigid Mineral-Fiber Board: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 1136, Type I, II, III, & IV with factory applied all-service jacket (ASJ) or Type II, IV with factory applied Foil Scrim Kraft (FSK) jacket.

J. Mineral-Fiber Blanket with Factory Applied FSK Jacket: Meet the requirements of ASTM C 1290, Type III, inorganic glass fibers bonded by a thermosetting resin with a multi-purpose foil-scrim kraft (FSK) jacket to maximum service temperature of 250°F. FSK shall meet the requirements of ASTM C 1136, Type II, when surface burning characteristics are determined in accordance with ASTM E 84 with the foil surface of the material exposed to the flame as it is in the final composite. Composite (insulation, facing and adhesive) shall not exceed 25 Flame Spread, 50 Smoke Developed when tested in accordance with ASTM E 84. Insulation properties shall be as follows:

1. Thickness: 1-1/2"
   a. Density: 0.75 pcf
   b. Minimum uncompressed R value: 5.0
   c. Minimum installed R value assuming 25% compression: 4.0
2. Thickness: 2"
   a. Density: 1.0 pcf
   b. Minimum uncompressed R value: 7.4
   c. Minimum installed R value assuming 25% compression: 6.0
3. Alternate to 2" 1.0 pcf: Thickness: 2.2"
   a. Density: 0.75 pcf
   b. Minimum uncompressed R value: 7.4
   c. Minimum installed R value assuming 25% compression: 6.0
4. Thickness: 3"

a. Density: 0.75 pcf
b. Minimum uncompressed R value: 10.0
c. Minimum installed R value assuming 25% compression: 8.3

K. Mineral-Fiber Pipe Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
2. Semi-Rigid Mineral-Fiber Board: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 1136, Type I, II, III, IV with factory applied all-service jacket (ASJ) or Type II, IV with factory applied Foil Scrim Kraft (FSK) jacket.
3. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
4. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
   a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
   b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
5. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
6. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
7. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
8. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

L. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

M. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.2 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Glass Cloth: Woven glass-fiber fabric, plain weave, minimum 8 ounces per square yard.

C. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

D. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.
2. PVC Duct Jacket Color: White or gray.
3. PVC Pipe Jacket Color: Color-code piping jackets based on materials contained within the piping system.

E. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209, and having an integrally bonded moisture barrier over entire surface in contact

with insulation. Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.

1. Finish and Thickness: Stucco-embossed finish, 0.016 inch thick.
2. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.
3. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

F. Heavy PVC Pipe Fitting Covers: Factory-fabricated fitting covers manufactured from 30-mil-thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

G. Standard PVC Pipe Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

2.3 REMOVABLE INSULATION COVERS

A. Pre-manufactured easily removable insulation cover/blanket intended for insulation of equipment and devices requiring periodic maintenance.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd..

1. Tape Width: 4 inches.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
2. Galvanized Steel: 0.005 inch thick.
3. Aluminum: 0.007 inch thick.
4. Brass: 0.010 inch thick.
5. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

D. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.

1. Welded Pin Holding Capacity: 100 lb for direct pull perpendicular to the attached surface.

E. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct, pipe, plenum and breeching with adhesive. Pin length sufficient for insulation thickness indicated.

1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, pipes, plenums, and breechings; and to achieve a holding capacity of 100 lb. for direct pull perpendicular to the adhered surface.

F. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct, pipe, and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.5 VAPOR RETARDERS

A. Mastics: Materials that are compatible with insulation materials, jackets, and substrates.

2.6 REMOVABLE INSULATION COVERS

A. Pre-manufactured easily removable insulation cover/blanket intended for insulation of equipment and devices requiring periodic maintenance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts, piping, and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thickness required for each system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

G. Keep insulation materials dry at all times. Insulation that becomes wet or is otherwise damaged beyond repair, shall be removed immediately and replaced. Replacement material and installation shall be in accordance with these specifications.

H. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

I. Apply insulation with the minimum number of joints practical.

J. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

K. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder to maintain vapor seal.
3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges, pipe joints, and fittings.

O. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

P. Install vapor-retarder mastic on ducts, pipes, plenums, and equipment.

1. Ducts, pipes, plenums, and equipment with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape and mastic to maintain vapor-retarder seal.
2. Ducts, pipes, plenums, and equipment without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

Q. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

S. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

T. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts, Pipes, and Plenums: Secure blanket insulation with adhesive, and anchor pins with speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct, pipe, and plenum surfaces.
2. Apply adhesive to entire circumference of ducts & pipes and to all surfaces of fittings and transitions. Adhesive may be omitted from the top of horizontal rectangular ducts.
3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
   c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not compress insulation to less than 75% of its original thickness during installation.
4. Install anchor pins and speed washers on sides, top, and bottom of horizontal pipes.
5. Impale insulation over anchors and attach speed washers.
6. Cut excess portion of pins extending beyond speed washers. Cover exposed pins and washers with tape matching insulation facing.
7. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1-inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
8. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
9. Apply insulation on rectangular duct elbows, pipe fittings, and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows, and pipe elbows, with individually mitered gores cut to fit the elbow.
10. Insulate duct and pipe stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material as insulation. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
11. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

B. Board Applications for Ducts, Plenums, & Equipment: Secure board insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct, plenum, & equipment surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings, transitions, and equipment. Adhesive may be omitted from top surface of horizontal rectangular ducts.
3. Space anchor pins as follows:
   a. On duct & equipment sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct & equipment sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at bracing.
   c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not compress insulation to less than 75% of its original thickness during installation.
4. Cut excess portion of pins extending beyond speed washers. Cover exposed pins and washers with tape matching insulation facing.
5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1-inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct and equipment stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6" wide strips of the insulating materia. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to ducts, plenums, and equipment as follows:

1. Follow the manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct, plenum, and equipment surface.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.

3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.7 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Paints."

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color shall be as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 DIFFUSER APPLICATIONS

A. Insulate exposed metal surfaces on top of all supply diffusers. Where diffusers are mounted in a metal pan insulate the top of the metal pan.

1. Material: Mineral-Fiber Blanket Thermal Insulation with Factory Applied FSK Jacket.
2. Thickness: 1 inch.
3. Vapor Retarder Required: Yes.

3.9 APPLICATIONS

A. Insulation materials and thickness are specified at the end of this Section.

B. Insulate all ductwork, pipe and equipment:

1. Insulate ductwork in accordance with the application schedule(s) below.
2. Exceptions: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
   a. Vibration-control devices.
   b. Testing agency labels and stamps.
   c. Nameplates and data plates.
   d. Manholes.
   e. Handholes.
   f. Cleanouts.
   g. Plastic condensate drain piping.
   h. Pipe-mounted condensate sensors.
   i. Return ductwork inside the building insulation envelope.
   j. Indoor exposed return air ductwork.
   k. Exhaust ductwork.
      1) Exception: Duct beginning 18" upstream of backdraft damper and continuing to building envelope insulation.
   l. Metal ducts with duct liner.
   m. Factory-insulated flexible ducts.
   n. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
   o. Flexible connectors.
   p. Vibration-control devices.
   q. Testing agency labels and stamps.
   r. Nameplates and data plates.
   s. Access panels and doors in air-distribution systems.

3.10 INDOOR APPLICATION SCHEDULE

A. Service: Condensate drain piping except plastic.

1. Insulation Material: Mineral fiber preformed pipe insulation or Flexible elastomeric.
2. Insulation Thickness: 1"
3. Vapor Retarder Required: Yes.
4. Finish: Exposed = Painted, concealed = none.

B. Service: Heating hot-water supply and return.

1. Insulation Material: Mineral fiber preformed pipe insulation.
2. Insulation Thickness: Apply the following insulation thicknesses:
   a. Steel, Copper, & PVC Pipe, Up to 1.5" diameter: 1-1/2 inches.
   b. Steel, Copper, & PVC Pipe, 2" diameter & up: 2 inches.
   c. Existing piping: Match existing thickness, minimum of 1 inch.
3. Vapor Retarder Required: No.
4. Finish: Exposed = Painted, concealed = none.

C. Service: Unless otherwise indicated provide the following:

1. Concealed Ducts and Plenums:
   a. Material: Mineral-Fiber Blanket.
   b. Thickness: 2 inches.
   c. Vapor Retarder Required: Yes.
2. Exposed Ducts and Plenums:
   a. Material: Mineral-Fiber Board.
   b. Thickness: 1-1/2 inches.
   c. Field-Applied Jacket: Glass cloth.
   d. Vapor Retarder Required: Yes.
   e. Paint: Color as selected by architect. Refer to section "Painting".

D. Service: Round and flat oval, supply-air ducts, concealed and within the building insulation envelope.

1. Material: Mineral-Fiber Blanket Thermal Insulation with Factory Applied FSK Jacket.
2. Thickness: 1-1/2 inches.
3. Vapor Retarder Required: Yes.

E. Service: Round and flat oval, outside-air ducts, concealed and within the building insulation envelope.

1. Material: Mineral-Fiber Blanket Thermal Insulation with Factory Applied FSK Jacket.
2. Thickness: 1-1/2 inches.
3. Vapor Retarder Required: Yes.

F. Service: Rectangular, supply-air ducts, concealed and within the building insulation envelope.

1. Material: Mineral-Fiber Blanket Thermal Insulation with Factory Applied FSK Jacket.
2. Thickness: 1-1/2 inches.
3. Vapor Retarder Required: Yes.

G. Service: Rectangular, outside-air ducts, concealed and within the building insulation envelope.

1. Material: Mineral-Fiber Blanket Thermal Insulation with Factory Applied FSK Jacket.
2. Thickness: 1-1/2 inches.
3. Vapor Retarder Required: Yes.

H. Service: Round and flat oval, supply-air ducts, exposed.

1. Refer to section "Metal Ducts"

I. Service: Rectangular, outside-air ducts, exposed.

1. Material: Mineral-Fiber Board Thermal Insulation, Unfaced
2. Thickness: 2 inches
3. Field-Applied Jacket: Glass cloth.
4. Vapor Retarder Required: Yes.
5. Paint: Color as selected by architect. Refer to section "Painting".

3.11 OUTDOOR APPLICATION SCHEDULE

A. Service: Refrigerant suction piping.

1. Insulation Material: Flexible elastomeric.
2. Insulation Thickness: 1 inches
3. Field-Applied Jacket: Aluminum.
4. Vapor Retarder Required: Yes
5. Finish: Two coats UV protectant applied to flexible elastomeric insulation prior to installation of aluminum jacket.

B. Insulation shall be applied after heat tracing and temperature sensors are in place and have been tested.

3.12 BOILER BREECHING AND CONNECTOR APPLICATION SCHEDULE

A. Boiler breechings and connectors shall be listed, labeled, factory-built, and insulated as specified in section "Breechings, Chimneys, and Stacks".

END OF SECTION 230700

SECTION 230900 – BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Related Sections include the following:

1. Division 23 Section "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
2. Division 23 Section "Sequences of Control" for requirements that relate to this Section.
3. Division 28 Sections for additional conduit requirements for all electronic safety and security systems specified under Division 28.

C. Work Under Other Sections:

1. All wells, valves, taps, dampers, flow stations, etc. furnished by the BAS manufacturer shall be installed under Section "Hydronic Piping."
2. The following shall be provided under Division 23 specifications sections:
   a. 120V power to BAS panels and devices with circuits indicated on the drawings. Refer to "Coordination" paragraph below.
   b. Wiring of power feeds to disconnect switches and starters.
   c. Wiring from disconnect switches and starters to electric motors.
   d. Wiring of any remote start/stop switches and manual or automatic motor speed control devices not furnished under this section of the specifications.

1.3 DEFINITIONS

A. BAS: Building Automation System.

B. DDC: Direct digital control.

C. I/O: Input/output.

D. IT: Information Technology.

E. IS: Information Systems.

F. LAN: Local Area Network.

G. MS/TP: Master-slave/token-passing

H. NAC: Network area controllers.

I. PC: Personal computer.

J. PID: Proportional plus integral plus derivative.

K. PPM: Parts per million.

L. RTD: Resistance temperature detector.

M. WAN: Wide-Area Network

1.4 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

    a. Water Temperature: Plus or minus 1 deg F.
    b. Water Flow: Plus or minus 5 percent of full scale.
    c. Water Pressure: Plus or minus 2 percent of full scale.
    d. Space Temperature: Plus or minus 1 deg F.
    e. Ducted Air Temperature: Plus or minus 1 deg F.
    f. Outside Air Temperature: Plus or minus 2 deg F.
    g. Dew Point Temperature: Plus or minus 3 deg F.
    h. Temperature Differential: Plus or minus 0.25 deg F.
    i. Relative Humidity: Plus or minus 5 percent.
    j. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
    k. Airflow (Terminal): Plus or minus 10 percent of full scale.
    l. Air Pressure (Space): Plus or minus 0.01-inch wg.

m. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
n. Carbon Dioxide: Plus or minus 50 ppm.
o. Electrical: Plus or minus 5 percent of reading.

1.5 SYSTEM DESCRIPTION

A. Control system consists of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

B. Control system includes interface to the following:
1. Division 28 sections on Electronic Safety and Security Systems. Provide interface outputs for selective annunciation and monitoring (i.e. alarm status).
2. Building clock control system specified in Division 27 Section "GPS Wireless Clock System."
3. Building lighting control system specified in Division 26 Section "Lighting Control Devices."
4. Fire alarm system specified in Division 28 Section "Digital Addressable Fire Alarm."

1.6 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year beginning on the date of Substantial Completion.

B. Services, materials, and equipment shall include but not be limited to:
1. The adjustment, required testing, and repair of the system including all computer equipment, transmission lines, transmission equipment, sensors and control devices.
2. On-line support services shall be provided as follows:
a. The local BAS representative shall have the capability to monitor and control the facility's building automation system via a dialup connection.
b. If the problem is not resolved by local support, the national office of the building automation system manufacturer, having the same dialup capability, shall also provide online support.

1.7 SUBMITTALS

A. Pre-submittal meeting: The Contractor performing work under this Section of the specifications shall attend a meeting for coordinating the control system with major pieces of equipment including air handling units, VAV boxes, existing VFD's and chillers. The meeting shall be held on the project site in the contractor's trailer or other location acceptable to the Contractor. The Contractor shall be responsible for arranging the meeting. Submittals shall be essentially complete at the time of the meeting so detailed coordination items can be discussed.

B. Submit ten (10) complete sets of documentation in the following phased delivery schedule:
1. Schedule of dampers including size, leakage, and flow characteristics.
2. Schedule of valves including leakage and flow characteristics.
3. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics,

finishes for materials, and installation and startup instructions for each type of product indicated. Include each control device labeled with setting or adjustable range of control.

4. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Include the following:
   a. System schematics, including:
      1) Written sequences of operation
      2) Listing of connected data points, including connected control unit and input device.
         a) point names
         b) point addresses
      3) Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
      4) Details of control panel faces, including controls, instruments, and labeling.
      5) Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
      6) Trunk cable schematic showing programmable control unit locations and trunk data conductors.
      7) System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
      8) System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

C. Maintenance Data: For systems to include in maintenance manuals specified in Division 1. Include the following:
   1. Maintenance instructions and lists of spare parts for each type of control device.
   2. Interconnection wiring diagrams with identified and numbered system components and devices.
   3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
   4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
   5. Calibration records and list of set points.

D. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

E. Upon project completion, submit operation and maintenance manuals, consisting of the following:
   1. Index sheet listing contents in alphabetical order.
   2. Manufacturer's equipment parts list of all functional components of the system.
   3. CD-ROM of system schematics including wiring diagrams.
   4. Sequence of operations
   5. As-built interconnection wiring diagrams.
   6. Operator's manual.
   7. Trunk cable schematic showing remote electronic panel locations and all trunk data.
   8. List of connected data points, including panels to which they are connected and input device (sensors, thermostat, etc.)
   9. Software and firmware operational documentation. Include the following:
      a. Software operating and upgrade manuals.

b. Program software backup: On a magnetic media or compact disc, complete with data files.
c. Device address list.
d. Printout of software application and graphic screens.
e. Software license required by and installed for DDC workstations and control systems.

10. Software Upgrade Kit: For Owner to use in modifying software to suit future power system revisions or monitoring and control revisions.
11. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. Submit product data sheets for airflow measuring devices indicating minimum placement requirements, sensor density, sensor distribution, and installed accuracy to the host control system. Submit a schedule of airflow measuring devices indicating compliance with specified accuracy at minimum and maximum airflow rates. Submit installation, operation and maintenance documentation.

1.8 QUALITY ASSURANCE

A. The BAS system shall be designed and installed, commissioned, and serviced by a manufacturer's authorized installer.

B. Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control systems similar to those indicated for this Project and with a record of successful in-service performance.

C. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specially for this project.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, governing radio frequency electromagnetic interference and shall be so labeled.

F. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory-mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.10 COORDINATION

A. Control Wiring: The BAS manufacturer shall be responsible for all BAS and temperature control wiring for a complete and operable system. All wire and cable shall be plenum-rated and shall be in accordance with Division 26 specification sections and all local, state and national codes and ordinances.

B. Where plenum-rated BAS cable is routed in concealed, accessible spaces, the cable may be run in the cable trays or in J-Hooks provided under this section of the specifications. Where plenum-rated BAS cable is routed in exposed or inaccessible areas, it shall be run conduit provided under this section of the specifications.

C. Power Wiring:
   1. Power wiring indicated (device and circuit designation indicated) on the drawings shall be provided under Division 26.
   2. The BAS manufacturer shall be responsible for power wiring not indicated (device or circuit designation not indicated) on the Drawings. It shall be the BAS manufacturer's responsibility to review the Contract Documents to determine the extent of power wiring included in Division 26 and to provide additional power wiring as required. Work shall be in accordance with Division 26 specifications and all local, state and national codes and ordinances.
   3. Where the contractor performing work under this section requires an additional circuit for power wiring to a device or panel under paragraph 2 above, an RFI shall be issued requesting approval to use an available circuit in the nearest panel. Once approval is granted, all wiring and conduit from the breaker to the device or panel shall be provided under this section of the specifications.

D. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. All conduits shall be concealed within walls and above ceilings unless indicated otherwise.

E. Coordinate installation of conduit to avoid cutting of finished surfaces.

F. Coordinate equipment with Division 28 Section "Common Work Results for Electronic Safety and Security" for building security control detection system and selective annunciation and monitoring only (i.e. 'status alarms').

G. Coordinate equipment with Division 27 Section "GPS Wireless Clock System" to achieve compatibility with equipment that interfaces with that system.

H. Coordinate equipment with Division 26 Section "Lighting Control Devices" to achieve compatibility with equipment that interfaces with that system.

I. Coordinate equipment with Division 28 Section "Digital Addressable Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

J. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

K. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

L. Coordinate equipment with Division 26 Section "Switchboards" to achieve compatibility with power monitoring and metering devices in that equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Alerton
2. Automated Logic
3. Honeywell
4. Johnson Controls Inc.
5. Trane
6. Schneider Electric
7. Siemens

B. This project requires the installation of a new building automation system constructed using a Niagara N4 Framework. The BAS shall utilize a Tridium JACE 8000 Controller networked with a Niagara N4 Framework. The building automation system shall be standardized on owner's existing N4 Tridium Web Supervisor.

C. The design of the BAS shall network any existing operator workstations located off-site, the new operator worksatation, the district supervisory server, network area controllers, and stand-alone DDC controllers. The network architecture shall consist of two levels: a high performance peer-to-peer network and DDC controller-specific local area networks. Access to the controller-specific LAN shall be totally transparent to the user when accessing data or developing control programs. The BAS shall be comprised of Network Area Controller(s) within each facility. The NAC shall connect to the owner's wide area network. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard web browsers, via the VPN access to the system's WAN. Each NAC shall communicate to LonMark/LonTalk (IDC) and/or BACnet (IBC) controllers provided under this Section.

D. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

E. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to

control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

F. Peer-to-Peer Network Level: All operator devices either network resident or connected via dial-up modems shall have the ability to access all point status and application report data, and to execute control functions for any and all other devices via the peer-to-peer network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.
   1. Telecommunication Capability:
      a. Auto-dial/auto-answer communications shall be provided to allow DDC Controllers to communicate with remote operator stations and/or remote terminals via telephone lines, as indicated in the sequence of operations. Existing modems and existing remote host software shall be utilized to meet existing connection system.
      b. Auto-dial DDC Controllers shall automatically place calls to workstations to report alarms or other significant events. The auto-dial program shall include provisions for handling busy signals, "no answers" and incomplete data transfers.
   2. Operators at dial-up workstations shall be able to perform all control functions, all report functions and all database generation and modification functions as described for workstations connected via the network. Routines shall be provided to automatically answer calls from remote DDC Controllers. The fact that communications are taking place with remote DDC Controllers over telephone lines shall be completely transparent to an operator.
   3. Main DDC panels shall be connected via fiber. All fiber, connection hardware, and work required for connection of main panels shall be included.
   4. An Ethernet connection shall be made to the exiting central maintenance host workstation. The contractor performing work under this section of the specifications shall meet with the Owner's IT or IS department and shall be responsible for providing a complete Ethernet connection over the Owner's existing network. All software, hardware, wiring, fiber, and components necessary shall be provided.

2.2 DDC EQUIPMENT

A. Operator Workstations: A new workstation should be provided in the existing building. All BAS interface software should be installed on the new workstation. Provide at least two hard copies on CD or DVD of all software required for interface. Provide 2 copies of software tools required to modify programming and sequences of operation.
   1. Application Software:
      a. I/O capability from operator station.
      b. System security for each operator via software password and access levels.
      c. Automatic system diagnostics; monitor system and report failures.
      d. Database creation and support.
      e. Automatic and manual database save and restore.
      f. Dynamic color graphic displays with up to 10 screen displays at once.
      g. Custom graphics generation and graphics library of HVAC equipment and symbols.
      h. Alarm processing, messages, and reactions.

i. Trend logs retrievable in spreadsheets and database programs.
j. Alarm and event processing.
k. Object and property status and control.
l. Automatic restart of field equipment on restoration of power.
m. Data collection, reports, and logs. Include standard reports for the following:
   1) Current values of all objects.
   2) Current alarm summary.
   3) Disabled objects.
   4) Alarm lockout objects.
   5) Logs.
n. Custom report development.
o. Workstation application editors for controllers and schedules.
p. Maintenance management.

B. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide either modulating signal, low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

C. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

2.3 DDC CONTROLLERS

A. No controller shall be loaded to more than 80%. IE: A controller with 20 available points shall be loaded with 16 points or less.

B. DDC controllers shall be stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient

to fully meet the requirements of the contract documents. Each controller shall support a minimum of two (2) LAN Device Networks.

C. Each DDC controller shall have sufficient memory to support its own operating system and databases, including:
   1. Control processes
   2. Energy management applications
   3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
   4. Historical/trend data for points specified.
   5. Maintenance support applications.
   6. Custom processes.
   7. Operator I/O.
   8. Dial-up communications.
   9. Manual override monitoring.

D. Each DDC controller shall support any combination of industry standard inputs and outputs.

E. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

F. DDC controllers shall provide a minimum two RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, Ethernet connections, printers, or terminals.

G. Each DDC controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

H. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.

I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 100 days.
   1. Upon restoration of normal power, the DDC controller shall automatically resume full operation without manual intervention.
   2. Should DDC controller memory be lost for any reason, the system shall automatically reload the DDC controller via the local RS-232C port, via telephone line dial-in or Ethernet from the existing network workstation PC.

J. Provide a separate DDC controller for each RTU or other HVAC system. It is intended that each unique system be provided with its own point resident DDC controller.

2.4 DDC CONTROLLER RESIDENT SOFTWARE FEATURES

A. General:
1. The software programs specified in this Section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher-level computer for execution.

B. Control Software Description:
1. The DDC Controllers shall have the ability to perform the following pre-tested control algorithms:
a. Two-position control
b. Proportional control
c. Proportional plus integral control
d. Proportional, integral, plus derivative control
e. Automatic tuning of control loops

C. DDC Controllers shall have the ability to perform any or all the following energy management routines:
1. Time-of-day scheduling
2. Calendar-based scheduling
3. Holiday scheduling
4. Temporary schedule overrides
5. Start-Stop Time Optimization
6. Automatic Daylight Savings Time Switchover
7. Night setback control
8. Enthalpy switchover (economizer)
9. Peak demand limiting
10. Temperature-compensated duty cycling
11. Trending

D. DDC Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.

F. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified.

2.5 APPLICATION SPECIFIC CONTROLLERS (ASC)

A. Each DDC Controller shall be able to extend its performance and capacity using remote application specific controllers (ASCs) through LAN Device Networks.

B. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Provide the following types of ASCs as a minimum:
   1. Terminal Equipment Controllers
      a. Terminal Box (VAV box controllers) should have a differential pressure transmitter (transducer) accuracy of 0.015-inches w.g. or less.

C. Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.

D. Terminal Equipment Controllers:
   1. Provide for control of each piece of equipment , including, but not limited to, the following:
      a. Terminal Boxes
      b. Exhaust fans
      c. Terminal Units

2.6 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters and Resistance Temperature Detectors and Transmitters:
   1. Accuracy: Plus or minus 0.5 deg F at calibration point.
   2. Wire: Twisted, shielded-pair cable.
   3. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
   4. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
   5. Insertion Elements for Liquids: Brass or stainless steel socket with minimum insertion length of 2-1/2 inches.
   6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
      a. Set-Point Adjustment (classrooms, offices, work/ resource rooms and conference rooms): Exposed warmer/cooler slider. Range of adjustment capable at zone sensor shall be programmable through the BAS.
      b. Set-Point Adjustment (other spaces/ common areas): Concealed.
      c. Set-Point Indication: Concealed.
      d. Thermometer: Concealed.
      e. Color: Manufacturer's standard.
      f. Orientation: Vertical.
   7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
   8. Space Sensor Guards: Provide heavy-duty, cast aluminum, hinged guards with security screws and lock for sensors located in the Gymnasium, Cafeteria/ Dining, Auditorium.
   9. Specific Sensor Type Locations: In corridors, restrooms/ toilets, stairs, and lobbies provide blank stainless-steel cover plate sensors with insulated back and security screws.

C. Humidity Sensors: Capacitance or bulk polymer resistance type.

1. Accuracy: 5 percent full range with linear output.
2. Room Sensor Range: 20 to 80 percent relative humidity.
3. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   a. Color: Manufacturer's standard.
   b. Orientation: Vertical.
4. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 0 to 185 deg F.
5. Duct-Mounted: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

D. Pressure Transmitters/Transducers:
1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input and temperature-compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0- to 0.25-inch wg.
   d. Duct Static-Pressure Range: 0- to 5-inch wg.
2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential. Accuracy shall be +/- 5% of range.
5. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.
6. Building Pressure Sensor: Manufacturers standard located above the ceiling with sensing tubes and cover plate in corridor ceiling in centralized/ average reading location for the unit it serves.

E. Current Sensing Switch:
1. Sensor supply voltage and supply current shall be induced from monitored conductor. Contact rating shall be 0.2 amperes at 30 volts DC/AC. Trip set point shall be adjustable to +/-1% of range. Current sensing switch wiring shall not be polarity sensitive.

F. Liquid Level Sensors:
1. Liquid level sensors shall have ½" accuracy calibrated to detect water in temperature range from 60°F to 80°F. Output signal shall be 4 to 20 mA. Sensor material shall be stainless steel or other non-corrosive material.

G. Freezer and Cooler Temperature Sensors:
1. Specifically manufactured to be moisture/water proof. Sensors shall be provided with 25' rugged cable to allow termination away from areas of condensation. Sensor shall be Kele part #ST-RS3-C, ST-R91S-C or approved equal.

2.7 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

G. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.8 CARBON DIOXIDE SENSORS AND TRANSMITTERS

A. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output, for wall mounting. LCD, digital display indicating CO2 concentrations in PPM. Measurement range of 0-2000 PPM with lifetime self-calibration or automatic background calibration. AirTest Series EE80 or approved equal.
   1. Space Sensor Guards: Provide heavy-duty, cast aluminum, hinged guards with security screws and lock for sensors located in the Gymnasium, Cafeteria/ Dining, Auditorium.

2.9 FLOW MEASURING STATIONS

A. Duct Airflow Station:

   1. Qualifications: The manufacturer shall have a minimum of ten years experience producing products of this type.
   2. Acceptable Manufacturers: Subject to compliance with requirements, provide products by Ebtron Inc. Unless otherwise noted model numbers shall be as follows:

      a. Model GTx116-PC for ducts and plenums.
      b. Model GTx116-F for fan inlet applications.

   3. Alternative Manufacturers: Alternative manufacturers may be submitted as a substitution in accordance with Division 1 specification requirements. Superior performance or lower cost to the owner must be provided. Acceptance shall be at the sole discretion of the Architect.

4. Special Warranty: In addition to other required warranties, provide 3 years on parts from the date of unit shipment.
5. Delivery, Storage and Handling: All handling and storage procedures shall be per manufacturer's recommendations. Airflow measuring devices shall be kept clean and dry, protected from weather and construction traffic.
6. Provide airflow/temperature measurement devices where indicated on the plans. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
7. The measurement device shall consist of one or more sensor probe assemblies and a single, remotely mounted, microprocessor-based transmitter. Each sensor probe assembly shall contain one or more independently wired sensor housings. The airflow and temperature readings, calculated for each sensor housing, shall be equally weighted and averaged by the transmitter prior to output. Pitot tubes and arrays are not acceptable. Vortex shedding flow meters are not acceptable.
8. Sensor Probe Assemblies:

    a. Sensor housings shall be manufactured of a U.L. listed engineered thermoplastic.
    b. Sensor housings shall utilize two hermetically sealed, bead-in-glass thermistor probes to determine airflow rate and ambient temperature. Devices that use "chip" or diode case type thermistors are unacceptable. Devices that do not have two thermistors in each sensor housing are not acceptable.
    c. Sensor housings shall be calibrated at a minimum of 16 airflow rates and have an accuracy of +/-2% of reading over the entire operating airflow range.
    d. Each sensor housing shall be calibrated to standards that are traceable to the National Institute of Standards and Technology (NIST).
    e. Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.
    f. Operating temperature range for the sensor probe assembly shall be -20° F to 160° F. The operating humidity range for the sensor probe assembly shall be 0-99% RH (non-condensing).
    g. Each temperature sensor shall be calibrated at a minimum of three temperatures and have an accuracy of +/-0.15° F over the entire operating temperature range. Each temperature sensor shall be calibrated to standards that are traceable to the National Institute of Standards and Technology (NIST).
    h. Each sensor probe assembly shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.
    i. Each sensor assembly shall not require matching to the transmitter in the field.
    j. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter at a given measurement location.
9. Duct and Plenum Sensor Probe Assemblies:
    a. Sensor housings shall be mounted in an extruded, 6063 aluminum tube probe assembly.
    b. Thermistor probes shall be mounted in sensor housings using an epoxy resin.
    c. All thermister probe wires shall be contained within the aluminum tube probe assembly.
    d. The number of sensor housings provided for each location shall be as follows:
        1) Area (sq.ft.) Sensors
        2) <2 4

3)	2 to <4	6
4)	4 to <8	8
5)	8 to <16	12
6)	>=16	16

e. Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:
   1) Insertion mounted through the side or top of the duct
   2) Internally mounted inside the duct or plenum
   3) Standoff mounted inside the plenum

f. The operating airflow range shall be 0 to 5,000 FPM unless otherwise indicated.

10. Fan Inlet Sensor Probe Assemblies:
   a. Sensor housings shall be mounted on 304 stainless steel blocks.
   b. Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel-plated steel.
   c. Mounting feet shall be constructed of 304 stainless steel.
   d. The operating airflow range shall be 0 to 10,000 FPM unless otherwise indicated.
11. Transmitters:
   a. The transmitter shall have a 16-character alphanumeric display capable of displaying airflow, temperature, system status, configuration settings and diagnostics. Configuration settings and diagnostics shall be accessed through a pushbutton interface on the main circuit board. Airflow shall be field configurable to be displayed as a velocity or a volumetric rate.
   b. The transmitter shall be capable of:
      1) Independently monitoring and averaging up to 16 individual airflow and temperature readings.
      2) Displaying the airflow and temperature readings of individual sensors on the LCD display.
   c. The transmitter shall have a power switch and operate on 24 VAC (isolation not required). The transmitter shall use a switching power supply fused and protected from transients and power surges.
   d. All interconnecting pins, headers and connections on the main circuit board, option cards and cable receptacles shall be gold plated.
   e. The operating temperature range for the transmitter shall be -20° F to 120° F. The transmitter shall be protected from weather and water.
   f. The transmitter shall be capable of communicating with the BAS using one of the following interface options:
      1) Linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire)
      2) RS-485: Field selectable BACnet-MS/TP
      3) Base-T Ethernet: Field selectable BACnet Ethernet, BACnet-IP
   g. The transmitter shall have an infrared interface capable of downloading individual sensor airflow and temperature data or uploading transmitter configuration data to a handheld PDA (Palm or Microsoft Pocket PC operating systems).
   h. The measuring device shall be UL listed as an entire assembly.
   i. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated. A written report shall be submitted to the architect should any measurement location not meet the manufacturer's placement requirements.

12. Installation: Install in accordance with manufacturer's instructions at locations indicated. A written report shall be submitted to the architect if any discrepancies are found.
13. Adjusting: Duct and plenum devices shall not be adjusted without the Architect's approval.

2.10 THERMOSTATS

A. Available Manufacturers:
1. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
2. Heat-Timer Corporation.
3. Tekmar Control Systems, Inc.

B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.

1. Label switches "FAN ON-OFF" or "FAN HIGH-LOW-OFF" or "FAN HIGH-MED-LOW-OFF."
2. Mount on single electric switch box.

C. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on every day of week.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:
   a. Time of day.
   b. Actual room temperature.
   c. Programmed temperature.
   d. Programmed time.
   e. Duration of timed override.
   f. Day of week.
   g. System mode indications include "heating," "off," "fan auto," and "fan on."

D. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

E. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.

2. Selector Switch: Integral, manual on-off-auto.

F. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.

1. Bulbs in water lines with separate wells of same material as bulb.
2. Bulbs in air ducts with flanges and shields.
3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

G. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

H. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

I. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.

1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

J. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.

1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

K. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.11 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Valves: Size for torque required for valve close off at maximum pump differential pressure.
2. Dampers: Size for running torque calculated as follows:
   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
   e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
   f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
6. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
7. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
8. Temperature Rating: Minus 22 to plus 122 deg F.
9. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.

2.12 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

B. Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.

1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.

3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.13 DAMPERS

A. Dampers: AMCA-rated, parallel or opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.14 SMOKE DETECTORS

A. Smoke detectors shall be furnished under Division 28 and installed under this Section.

B. Wiring from smoke detectors to fire alarm system shall be under Division 28.

C. Wiring from smoke detectors to mechanical equipment shall be under this Section.

2.15 LOW TEMPERATURE DETECTION STAT: By BAS manufacturer, adjustable freeze stats from 32-40°F set point.

2.16 CURRENT SENSING RELAYS: By controls contractor for all equipment.

2.17 MISCELLANEOUS RELAYS AND SWITCHES:

A. General: Where required by the sequence of operation switches, relays, and miscellaneous devices necessary to accomplish the sequence shall be provided under this section.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

A. Provide a designated project manager who will be responsible for the following:

1. Construct and maintain project schedule
2. On-site coordination with all applicable trades and subcontractors
3. Authorized to accept and execute orders or instructions from owner/architect
4. Attend project meetings as necessary to avoid conflicts and delays
5. Make necessary field decisions relating to this scope of work
6. Coordination/Single point of contact.

3.2 EXAMINATION

A. Verify that power supply is available to control units and operator workstation.

B. Verify that duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.3 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified in Section 23 section "Sequences of Control."

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices next to light switch(es) when space is available with top of device at 48 inches above finished floor. Where space next to light switch(es) is not available, align device vertically with light switch and locate device with top at 40 inches above the finished floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats where indicated on Drawings. Provide cast aluminum hinged guards on sensors serving the gymnasium/cafeteria.

E. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

F. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

G. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
6. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
7. Check temperature instruments and material and length of sensing elements.
8. Check control valves. Verify that they are in correct direction.
9. Check DDC system as follows:

    a. Verify that DDC controller power supply is from emergency power supply.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:

a. Check analog inputs at 0, 50, and 100 percent of span.
b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
c. Check digital inputs using jumper wire.
d. Check digital outputs using ohmmeter to test for contact making or breaking.
e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:

a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
b. Manually operate flow switches to verify that they make or break contact.

6. Pressure:

a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. Temperature:

a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 TRAINING

A. Provide 8 hours of training for Owner's designated operating personnel. Training shall include:
1. Explanation of drawings and operation & maintenance manuals
2. Walk-through of the job to locate control components
3. Operator workstation and peripherals
4. Operation of Portable computer
5. DDC controller and ASC operation/function
6. Operator control functions including graphic generation and field panel programming

7. Explanation of adjustment, calibration and replacement procedures

B. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available form the Manufacturer. If necessary additional training will be contracted by the Owner at a later date.

C. Coordinate with Owner if video recording documentation of training is required.

3.7 COMMISSIONING

A. Provide up to 16 hours for commissioning/ engineer testing and verification of the controls. This may include providing trends, modified programming, on-site testing, and similar testing and verification methods to ensure the controls are functioning as intended by the sequence of controls.

B. Provide the AE with read-only remote access to the BAS network 1 month prior to substantial completion date. All programming and graphics shall be in place 1 month prior to substantial completion date to allow for engineer testing and verification. A login in and server access must be identified and provided five weeks prior to substantial completion.

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 ABBREVIATIONS

A. AFMS: Air Flow Measuring Station

B. BAS: Building Automation System

C. BCM: Boiler Communication Module

D. CO_2: Carbon Dioxide

E. CFM: Cubic Feet per Minute

F. DX: Direct Expansion

G. DDC: Direct-digital controls

H. °F: Degrees Fahrenheit

I. PPM: Parts Per Million

J. ECM: Electrically-commutated motor

K. AHU: Air handling unit

L. TAB: Testing, Adjusting & Balancing

M. VAV: Variable-air volume

N. NCSBC: North Carolina Statewide Building Code

O. VFD: Variable-Frequency Drive

1.3 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 23 Section "Building Automation System" for control equipment and devices and for submittal requirements.

1.4 GENERAL REQUIREMENTS OF THIS SECTION

A. Control sequences shall be accomplished in accordance with control drawings and the sequences specified in this section. It is the intent of this section to utilize sequences included in pre-programmed controllers when such sequences provide the intended operation.

B. Points may not be deleted without prior approval from the Architect.

C. Every attempt has been made to indicate all required points on the control drawings. Occasionally an additional point, or points, may be required to accomplish a specified sequence. The contractor performing work under this section shall understand the work to be implied and required by the contract documents. Additional hardware and software required shall be provided under section "Building Automation System" at no additional cost to the Owner.

1. Such points include:
   a. Sensors of all types whether or not specified under section "Building Automation System"
   b. Air flow measuring stations.
   c. Wiring, conduit, and related devices such as relays.
2. Exceptions:
   a. Equipment and devices covered under sections other than "Building Automation System".

1.5 DISPLAY GRAPHICS:

A. Include system schematic for each system. Indicate all points in system on at least one graphic.

B. Indicate all commanded values and temperatures.

C. Indicate all sensed temperatures.

D. Indicate all alarms.

E. Indicate all status points.

F. Indicate all monitored conditions.

1.6 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year beginning on the date of substantial completion.

1.7 SUBMITTALS

A. Refer to Section "Building Automation System."

PART 2 - SEQUENCES

2.1 SET POINTS: Unless indicated otherwise all set points shall be adjustable from the head end.

2.2 OCCUPIED / UNOCCUPIED

A. The BAS shall institute occupied and unoccupied control sequences based on a time-of-day schedule furnished by the Owner.

B. The Owner shall have the capability to program holidays and special functions.

C. The owner shall have the ability to override occupied / unoccupied maintenance / and unoccupied operation of each piece of equipment from the head end.

2.3 OPTIMUM START:

A. The BAS shall institute optimum start strategies for morning warm up and cool down functions. Equipment shall start early enough to restore occupied temperature set points 30 minutes prior to occupancy.

2.4 OUTSIDE AIR SENSORS:

A. Temperature: The BAS shall monitor outside air temperature as sensed by the outside air temperature sensor.

B. Humidity: The BAS shall monitor outside air relative humidity as sensed by the outside air humidity sensor.

2.5 HOT WATER SYSTEM

A. Initial Set points:

1. Heating Hot Water Loop Supply Temperature: 140°F

B. Hot water temperature reset:

1. Hot water temperature set point shall be re-set based on the following outside air temperatures.

Outside Air Temperature (°F)	Hot Water Temperature (°F)
<=35	140
40	135

45	130
50	125
55	120
60	115
>=65	110

C. Monitoring Points:

1. Heating Hot Water Loop Return Temperature
2. Heating Hot Water Loop Supply Temperature
3. Pump Speed
4. Pump Alarm
5. VFD Alarm
6. Boiler Alarm
7. Boiler Status
8. Boiler Capacity

D. General: The system consists of two condensing type, gas-fired, hot water boilers with primary pumps for each boiler, and two variable speed secondary hot water pumps. The BAS shall control system pumping, enable the boiler manufacturers' Boiler Management System (BMS) panel to operate the boilers, and provide a Hot Water Supply setpoint signal.

E. Pump Selection

1. Pumps P-3 and P-4 shall be controlled through the BAS with Active/Stand-by rotation. The Active/Stand-by status of the pumps shall be rotated through the BAS automatically based on a program to equalize pump run times. Pump Active/Standby status shall be automatically rotated weekly.
    a. This rotation shall be schedules as determined by Owner. The initial schedule shall be Mondays at 8:00 am.
    b. To prevent a boiler from shutting down on due to a loss of flow, if a pump is already running the Standby pump shall be engaged and proof On prior to shutting down one of the active pumps.

F. Boiler Plant Control

1. Enable/Disable Control Parameters
    a. The BAS system shall be programmed with the following parameters to enable the boiler plant:
        1) The BAS shall enable the boiler plant anytime the outdoor air temperature is 50°F (adj) or below. While the outside air temperature is 50°F or below, the boiler plant shall remain in constant operation.
        2) The BAS system shall monitor all HVAC equipment (AHUs, Air Terminal units, and Unit Heaters) served by this boiler plant. While the outside air temperature is above 50°F, a call for Hot Water from any one(1) AHU/RTU or any three(3) air terminal units (VAV or BC) shall trigger the BAS system to enable the boiler plant (Start the pumps and send the Enable command to the BMS).

3) While the outside air temperature is above 50°F, if none of the HVAC equipment (AHUs/RTUs, Air Terminal units, and Blower Coil) call for Hot Water for a minimum of 15 minutes (adj.) the BAS shall disable the BMS and shut down the pumps.

2. Pump Speed Control

a. Loop Differential Pressure

1) The BAS shall monitor the Differential Pressure Transmitters on the HW loop piping. The BAS system shall be programmed to modulate the speed of the pump to maintain the HW loop differential pressure.

2) The BAS shall monitor the remote DP transducers, each DP shall be provided with its own setpoint. This setpoint shall be established with coordination from the TAB contractor. The setpoint value shall be the optimum differential pressure for that portion of the system.

3) The differential pressure sensors shall be calibrated to record pressure in PSI and Feet of Water Column.

4) The BAS shall simultaneously monitor all DP values and run separate pump speed calculations for each based on its individual setpoint and pressure value. The BAS shall pass the maximum calculated pump speed signal to the pump control output.

b. Pump Minimum Speed/GPM

1) Minimum pump speed shall be limited to the minimum operating flow rate of the pump.

3. Pump Failure

a. Upon detection of pump failure via a pump current switch or VFD Fault status, the BAS shall initiate a "Pump Failure" sequence.

1) When the BAS detects a pump failure the BAS shall start the stand-by pump.
The failed active pump shall remain "On" for 60 seconds.

2) If the failed active pump run status is picked up again (the pump was shut down for a brief period) the BAS shall shut down the standby pump and resume operation of the active pump.

If the failed active pump run status is not picked up again (the pump was shut down or failed) the BAS shall shut down the failed active pump and continue operation of the stand-by pump.

3) A message shall be recorded to indicate a problem was detected and the automatic pump rotation was sequenced to continue operation.

b. Should both hot water pumps fail to operate a "Heating System Failure" alarm shall be recorded.

G. System Monitoring and Alarming

1. The BAS shall monitor all pump status, drive speed feedback, drive faults, pump run times and the HW loop differential pressure.

2. The BAS system shall accumulate run time for the pump motors.

3. HW Loop alarm conditions:

a. The BAS shall report any detected sensor failure.

b. The BAS shall monitor the building HW loop differential pressure. The BAS shall have a 5 min. initial delay after pump startup or Active/Standby rotation to allow the system to stabilize. After this initial delay all pressure alarms shall be immediately triggered. The BAS shall disable the alarm when the HW pumps are not operating. The BAS shall signal an alarm anytime any building loop DP sensor is 5 psi below the setpoint for more than 5 minutes.
c. The BAS shall monitor the Fault status for the pumps. The BAS shall trigger an alarm "HW Pump VFD Fault Alarm" when the VFD Fault input is activated.
d. The BAS shall monitor the speed feedback for the HW pumps. The BAS shall trigger an alarm "HW Pump Speed Alarm" when the feedback signal is not ± 2% of the command signal.

4. Boiler system alarm conditions:

a. The BAS shall report any detected sensor failure.
b. The BAS shall alarm any hot water system temperature sensor that is less than 35°F.
c. The BAS shall alarm any time the Building HW supply temperature is less than 5°F (adj.) below setpoint for more than 20 min. (adj.) and the BMS has been enabled.

H. Boiler Management System (BMS) Interface

1. The BMS shall interface with the BAS for all points available and show graphics with a similar configuration of the boilers, but at a minimum include the following points:

a. Each Boiler Leaving Water Temperature.
b. Each Boiler Entering Water Temperature.
c. Each Boiler Commanded Supply Water Set point.
d. Each Boilers Primary Pump Status.
e. Each Boiler Primary Pump Speed.
f. Each Boiler Primary Pump Alarm.
g. Each Boilers General Alarm.
h. Each Boilers firing rate/ % capacity.
i. Each Boilers flue stack discharge temperature.
j. Each Boilers Detailed Item Alarm such as "flame out" or "ignition failure", where a minimum of 10 of these specific alarms shall be mapped and coordinated with boiler manufacturer for most common alarms that are useful for remote monitoring/ troubleshooting.

2.6 VAV AIR-HANDLING UNITS SERVING TERMINAL UNITS– RTU-1 & 2

A. General: This air handling unit includes a variable speed supply and relief fan w/VFDs, modulating outside air damper, modulating return air damper, two-position relief air damper, packaged direct expansion (DX) cooling, modulating hot water control valve, and outdoor air flow measuring station. It provides temperature and dehumidification control for terminal units. Units serving spaces having more than 40 occupants per 1,000 SF and more than 500 SF will be controlled by space CO_2 sensors. Space CO_2 sensors are indicated on floor plans.

B. Initial Set Points:

1. Occupied:
   a. Minimum Leaving Air Temperature: 55°F.
   b. Maximum Leaving Air Temperature: 65ºF.
   c. Space Relative Humidity: 55% RH
   d. Economizer high limit temperature: 68°F
   e. CO_2: Outside Air CO_2 PPM + 400 PPM

2. Unoccupied:
   a. Minimum Leaving Air Temperature: 55°F.
   b. Maximum Leaving Air Temperature: 65ºF.
   c. Space Relative Humidity: 60% RH
   d. Economizer high limit temperature: 68°F
   e. CO_2: N/A (Outside air dampers closed/relief fan off)
   f.

C. Enable/Disable:
   1. Occupied Operation: During occupied hours, the unit shall be enabled, the supply fan shall be started, and dampers shall modulate in accordance with applicable sequences below.
   2. Unoccupied Operation: During unoccupied hours, the supply fan shall be cycled on and off to maintain unoccupied set points with outdoor air damper (D-1) and relief air damper (D-3) closed and return air damper (D-2) open.
      a. Unoccupied Heating: Should any of the unoccupied space temperatures fall below the unoccupied heating space temperature set point (control to worst case zone), the unit shall be started in the warm-up mode until the space (worst case zone) temperature rises 5°F above the unoccupied heating space temperature set point.
      b. Unoccupied Cooling: Should any of the unoccupied space temperatures rise above the unoccupied cooling space temperature set point (control to worst case zone), the unit shall be started in the cool-down mode until the space (worst case zone) temperature falls 5°F below the unoccupied cooling space temperature set point.
   3. Warm-up Operation: The BAS shall optimize the early start of the unit in warm-up mode to reach the occupied space heating set point by the occupied time. During warm-up operation the outside air damper (D-1) and relief air damper (D-3) shall be closed and return air damper (D-2) open. During morning warm-up the leaving air temperature will be reset up to 70°F (adjustable).
   4. Cool-down Operation: The BAS shall optimize the early start of the unit in cool-down mode to reach the occupied space cooling set point by the occupied time. During cool-down operation the outside air damper (D-1) and relief air damper (D-3) shall be closed and return air damper (D-2) open.
   5. Startup: Start time shall be based on the BAS optimum start programming in accordance with a predetermined schedule to be furnished by the Owner and programmed into the BAS. The outside air dampers shall remain closed while the unit operates in warm-up/cool-down mode to restore occupied set points. At occupancy time, the BAS shall begin to modulate the outside air damper in accordance with its sequence of control.

D. Supply Fan Control:
   1. During unoccupied hours, the fan shall be cycled as necessary to maintain worst case zone set points. When fan is cycled on, control shall be similar to occupied operation.

2. During occupied hours, the BAS shall start the supply fan at its minimum speed. The required speed shall be determined by the equipment manufacturer and shall be instituted as the minimum fan speed.
3. Speed Control:
   a. A static pressure sensor shall be located as indicated on drawings. The static pressure sensor shall function as the control input to the BAS (and thus to the supply fan VFD) such that a fall in down-duct static pressure will result in a proportional increase in supply fan speed to maintain set point. The static pressure set point shall be determined in accordance with "Down-duct Static Pressure Set Point" below. On a rise in down-duct static pressure, the reverse shall occur. Initial maximum static pressure set-point shall be 1.0 inches W.G. and shall be adjustable.
   b. Down-duct Static Pressure Set Point: The BAS shall continuously monitor the damper position (air valve) of all terminal units. When any damper opens beyond the maximum set point (initially 95%), the BAS shall reset the down-duct static pressure set point upward by 5% (adjustable) of the maximum static pressure set point. This shall occur at 10 minute (adjustable) intervals until no damper is more than 95% open, or the static pressure set point has been reset upward to the system maximum setting, or the VFD is at its maximum setting. When all dampers are opened less than the minimum set point (initially 85%), the BAS shall reset the down-duct static pressure set-point downward by 5% (adjustable) of the maximum system static pressure set point. This shall occur at 10 minute (adjustable) intervals until any damper is more than 85% open, or the VFD is at its minimum setting.
   c. High limit static pressure sensor is located in the supply fan discharge and shall function as a safety input to the BAS. An increase in fan discharge static pressure above set point (initially 4 inches w.g.) shall cause the BAS to stop the supply fan. An alarm shall be sent to the BAS that the unit has been shut down due to fan over-speed.
4. Drive Malfunction: Should the VFD malfunction as indicated by drive alarm circuit, an alarm shall be sent to the head end. The fan shall continue to operate unless deactivated by the VFD protection circuitry.
5. Fan Failure Alarm: Should the supply fan fail (sensed by the VFD), the unit shall be disabled, and an alarm shall be sent to the head end identifying the unit and stating that the supply fan has failed.
6. CO_2 Control: Whenever the outside air damper is completely open and CO_2 concentration rises above set point, the BAS shall override temperature control and shall modulate fan speed from minimum to maximum as required to maintain CO_2 set point.

E. Relief Fan Control:

1. During occupied hours and during economizer operation, the fan shall be started.
2. Speed Control:
   a. The BAS shall modulate the relief fan speed to maintain building pressurization at set point (as sensed by the building pressure sensor).
3. Minimum Fan Speed: Motor speeds below the manufacturer's recommended minimum RPM shall not be permitted. Minimum airflow is based on 20% of design relief fan airflow.
4. During unoccupied hours, the fan shall be deactivated.

5. Drive Malfunction: Should the VFD malfunction as indicated by drive alarm circuit, an alarm shall be sent to the head end. The fan shall continue to operate unless deactivated by the VFDs protection circuitry.
6. Fan Failure Alarm: Should the relief fan fail (sensed by the VFD), the unit shall be disabled, and an alarm shall be sent to the head end identifying the unit and stating that the supply fan has failed. Economizer operation shall cease, outdoor air damper shall close, and the return damper shall open.

F. Packaged DX cooling controls:

1. If cooling mode is enabled, the heating coil control valve shall be positioned fully closed.
2. Cooling system shall modulate to maintain unit leaving air temperature at set point.
3. Unit Leaving Air Temperature: Leaving air temperature shall be sensed by a temperature sensor located in the unit discharge or in the supply air duct.

G. Heating Coil Control Valve:

1. If the heating coil control valve is commanded open the cooling coil control valve shall be positioned fully closed.
2. The heating coil control valve shall modulate to maintain unit leaving air temperature at set point. On a rise in unit leaving air temperature the valve will modulate towards closed. On a fall in unit leaving air temperature the valve will modulate towards open.
3. Unit Leaving Air Temperature: Leaving air temperature shall be sensed by a temperature sensor located in the unit discharge or in the supply air duct.

H. Leaving Air Temperature Reset:

1. Whenever all of terminal VAV boxes are at 75% or less (adjustable) of their maximum airflow, the leaving air temperature set point shall be increased 1°F (adjustable) every 10 minutes (adjustable) until the leaving air temperature set point is reset up to its maximum. If any terminal VAV boxes rise above 75% of their maximum airflow, the inverse shall occur.
2. Whenever any terminal VAV box is at its maximum airflow the leaving air temperature set point shall be reset to its minimum.
3. Whenever all terminal VAV boxes are in heating mode, the leaving air temperature shall be reset up to its maximum.

I. Dehumidification Mode: During occupied or unoccupied operation when the relative humidity (as sensed by the return duct relative humidity sensor) rises above set point, the unit shall be placed in dehumidification mode. The BAS shall reset the leaving air temperature set point to minimum. The unit shall remain in dehumidification mode until the space relative humidity drops to 5% RH below set point at which time the BAS shall return to normal leaving air temperature reset control. Refer to applicable paragraphs for operation of valves, dampers, and fans.

J. Economizer Mode: Whenever outside air temperature is less than the economizer high limit temperature set point (adjustable) and outside air temperature is less than the return air temperature and cooling is required, economizer operation shall be enabled.

1. Economizer operation shall be available twenty-four hours per day.
2. Economizer Mode shall be disabled during dehumidification mode.

K. Outdoor Air Damper (D-1):
   1. Unoccupied: Damper shall be fully closed.
   2. Occupied: The damper shall modulate to open inversely with the return air damper (D-2) to maintain scheduled outdoor air (as sensed by the outdoor air flow measuring). If the damper fails bring in design outdoor air within +-10% after 5 minutes (adjustable), an alarm shall be sent to the head end identifying the unit and stating that the unit is not providing design outdoor air.
   3. Occupied: The BAS shall modulate dampers to provide the minimum outdoor air necessary to maintain CO_2 at set point (as sensed by the wall-mounted CO_2 sensor). At 150 PPM below set point, the dampers shall be closed. At 50 PPM above set point, the damper shall open to provide the scheduled maximum outdoor air (as sensed by the air flow measuring sensor),
   4. Economizer Mode with outdoor air temperature equal to or higher than supply air temperature set point: The BAS shall fully open the damper.
   5. Economizer Mode with outdoor air temperature lower than supply air temperature set point: The BAS shall modulate the damper inversely with the return air damper (D-2) to maintain the leaving air temperature set point.
   6. Air Flow Measuring: Outdoor airflow shall be reported to the BAS in total CFM the intake is bringing in and it shall be indicated on the head end graphics.

L. Return Air Damper (D-2):
   1. Unoccupied: Damper shall be fully open.
   2. Occupied: The damper shall modulate to close inversely with the outdoor air damper (D-1) to maintain scheduled outdoor air (as sensed by the outdoor air flow measuring station).
   3. Economizer Mode with outdoor air temperature equal to or higher than supply air temperature set point: The BAS shall fully close the damper.
   4. Economizer Mode with outdoor air temperature lower than supply air temperature: The BAS shall modulate the damper inversely with the outdoor air damper (D-1) to maintain the leaving air temperature set point.

M. Relief Air Damper (D-3) :
   1. Unoccupied: Damper shall be fully closed.
   2. Occupied Mode: The dampers shall open when the fan is energized.
   3. Economizer Mode: The dampers shall open when the fan is energized.

N. Life Safety: Duct smoke detectors are located in the return air duct, upon detection of products of combustion from any detector, signal the building fire alarm system and shut down the unit & hardwired shutdown of supply fan and close all dampers. This function shall be manually reset from the unit and shall be so identified on the head-end graphics. An alarm shall also be provided to the BAS head-end.

O. Freeze Protection: If the air temperature leaving the cooling coil falls below 38°F (as sensed by a freezestat with an averaging bulb located downstream of the cooling coil) the supply fan shall stop and the outdoor air and relief air dampers shall close and return air dampers shall open via

hard-wired connections. A high level freeze alarm should be issued to the head end. Heating coil control valve should fail open.

P. System Safety: Whenever the supply fan is stopped or airflow ceases for any reason (as sensed by the motor status sensing circuit), the supply and relief fan shall be deactivated and alarm issued to BAS. The outdoor air damper (D-1) and relief air damper (D-3) shall be closed and return damper (D-2) open. In all modes of operation, commanded position values for all control devices such as dampers shall be readable from the head-end.

Q. Condensate Pan Overflow Prevention: BAS shall monitor the condensate overflow switch in the condensate pan under the chilled water coil. If the float switch detects the pan is about to overflow and has reached its high limit, the BAS shall disable the cooling and issue an alarm to the BAS.

2.7 PARALLEL FAN POWERED TERMINAL UNIT WITH REHEAT COIL

A. DESCRIPTION: Cooling & heating with hot water heating coil, ceiling mounted, parallel (intermittently operating fan) fan powered, primary air control, variable air volume terminal unit. The unit contains a characterized damper, a pitot type flow measuring device with transducer, a fan in parallel with primary air, and a hot water coil. The velocity of air, as sensed by the flow sensor/transducer combination using a calculation with a known diameter provides flow (CFM) information to the BAS. The temperature of the space, as sensed by the space temperature sensor, allows the controller to determine the required CFM for cooling, when to start the fan and whether to position the hot water control valve open or closed.

B. Set points

1. Occupied Mode:

   a. Cooling: 75° F
   b. Heating: 70° F

2. Unoccupied:

   a. Cooling: 85° F
   b. Heating: 55° F

C. Cooling:

1. On a rise in space temperature, as sensed by the space temperature sensor, above the cooling set point, the BAS shall modulate the terminal unit air valve open in response to the increase in space temperature until the maximum indicated CFM is reached.

2. On a fall in space temperature, as sensed by the space temperature sensor, the reverse shall occur until the minimum indicated CFM is reached.

D. Heating:

1. On fall in space temperature, as sensed by the space temperature sensor, to the heating set point the BAS shall start the terminal unit fan.

2. On a continued fall in space temperature, as sensed by the space temperature sensor, the BAS shall modulate open the hot water control valve to maintain space temperature.

3. On a rise in space temperature, as sensed by the space temperature sensor, the reverse shall occur.

E. Monitoring points: The following information shall be sent to the BAS by the unitary controller and subsequently displayed on the head end graphics.

1. Air valve position feedback.
2. Measured/calculated primary air flow.
3. Fan status
4. Discharge air temperature.

F. Deadband: A five-degree (5°F) deadband shall be maintained between heating and cooling set points at all times.

2.8 SERIES FAN POWERED TERMINAL UNIT WITH REHEAT COIL

A. DESCRIPTION: Cooling & heating with hot water heating coil, ceiling mounted, series (continuously operating fan) fan powered, primary air control, variable air volume terminal unit. The unit contains a characterized damper, a pitot type flow measuring device with transducer, a fan in series with primary air, and a hot water coil. The velocity of air, as sensed by the flow sensor/transducer combination using a calculation with a known diameter provides flow (CFM) information to the BAS. The temperature of the space, as sensed by the space temperature sensor, allows the controller to determine the required CFM for cooling, when to start the fan and whether to position the hot water control valve open or closed.

B. Set points

1. Occupied Mode:
   a. Cooling: 75° F
   b. Heating: 70° F
2. Unoccupied:
   a. Cooling: 85° F
   b. Heating: 55° F

C. Cooling:

1. On a rise in space temperature, as sensed by the space temperature sensor, above the cooling set point, the BAS shall modulate the terminal unit air valve open in response to the increase in space temperature until the maximum indicated CFM is reached.
2. On a fall in space temperature, as sensed by the space temperature sensor, the reverse shall occur until the minimum indicated CFM is reached.

D. Heating:

1. On fall in space temperature, as sensed by the space temperature sensor, to the heating set point the BAS shall start the terminal unit fan.

2. On a continued fall in space temperature, as sensed by the space temperature sensor, the BAS shall modulate open the hot water control valve to maintain space temperature.

3. On a rise in space temperature, as sensed by the space temperature sensor, the reverse shall occur.

E. Monitoring points: The following information shall be sent to the BAS by the unitary controller and subsequently displayed on the head end graphics.

1. Air valve position feedback.

2. Measured/calculated primary air flow.

3. Fan status

4. Discharge air temperature.

F. Deadband: A five-degree (5°F) deadband shall be maintained between heating and cooling set points at all times.

2.9 TERMINAL UNIT WITH REHEAT COIL

A. DESCRIPTION: Cooling & heating with hot water heating coil, ceiling mounted, primary air control, variable air volume terminal unit. The unit contains a characterized damper, a pitot type velocity measuring device with transducer, and a hot water heating coil. The velocity of air, as sensed by the velocity sensor/transducer combination using a calculation with a known diameter provides flow (CFM) information to the BAS. The temperature of the space, as sensed by the space temperature sensor, allows the controller to determine the required CFM for cooling, and whether to open or close the hot water control valve.

B. Set points

1. Occupied Mode:

a. Cooling: 75° F
b. Heating: 70° F

2. Unoccupied:

a. Cooling: 85° F
b. Heating: 55° F

C. Cooling:

1. On a rise in space temperature, as sensed by the space temperature sensor, above the cooling set point, the BAS shall modulate the terminal unit air valve open in response to the increase in space temperature until the maximum cooling indicated CFM is reached.

2. On a fall in space temperature, as sensed by the space temperature sensor, the reverse shall occur until the minimum cooling indicated CFM is reached.

D. Heating:

1. On a fall in space temperature, as sensed by the space temperature sensor, the BAS shall modulate open the hot water control valve and adjust the air valve to maintain the heating indicated CFM.
2. On a rise in space temperature, as sensed by the space temperature sensor, the reverse shall occur.

E. Monitoring points: The following information shall be sent to the BAS by the unitary controller and subsequently displayed on the head end graphics.

1. Air valve position feedback.
2. Measured/calculated primary air flow.
3. Discharge air temperature.

F. Deadband: A five-degree (5°F) deadband shall be maintained between heating and cooling set points at all times.

2.10 HOT WATER UNIT HEATER

A. General: These units are provided to control conditions in stairs and mechanical spaces and consist of a fan and heating coil. Temperature sensors shall be unit mounted in control panel.

B. Initial Set Points:
1. Space Temperature
   a. Occupied:
      1) Heating: 70°F.
   b. Unoccupied:
      1) Heating: 60°F.

C. Startup: Start time shall be based on the BAS optimum start programming in accordance with a predetermined schedule to be furnished by the Owner and programmed into the BAS.

D. Space Temperature Control:
1. Heating: On a fall in space temperature below set point (as sensed by the space temperature sensor), the BAS shall start the fan. On a rise to set point, the BAS shall stop the fan.
2. Control Valve Actuator shall be spring fail open.

E. Fan Failure Alarm: Should the supply fan fail (as sensed by its current sensing relay), an alarm shall be sent to the head end identifying the unit and stating that the supply fan has failed or air flow has ceased. The unit shall be disabled.

2.11 DUCTLESS SPLIT SYSTEM AIR CONDITIONING UNITS

A. The BAS shall monitor the Ductless Split system controls for alarm status. If the system controls report an alarm (common alarm output), the BAS shall forward that alarm to the head end identifying the unit and stating that the Ductless Split system controls have reported an alarm.

B. The BAS shall monitor the space temperature in the rooms served by Ductless Split Systems. These sensors are used for monitoring purposes and shall alarm if they deviate more from the below set points:

1. Alarm High Limit Temperature: 85°F.

2.12 ROOFTOP & IN-LINE EXHAUST FAN (BAS SCHEDULE)

A. General: These are general duty fans that operate on a time-of-day-schedule. Refer to Fan Schedule for fan information.

B. Set points:

1. Occupied mode:

a. Fan Commanded Position: On

2. Unoccupied:

a. Fan Commended Position: Off

C. Start/Stop:

1. The fan shall be Started and Stopped by the BAS on an occupancy schedule to be provided by the Owner's representative.

D. Monitoring points: The following information shall be sent to the BAS by the unitary controller and subsequently displayed on the head end graphics.

1. Fan alarm status:

a. The BAS shall place the fan in alarm when the fan is commanded on, and the CSR indicates less than 66% of design power is being delivered.
b. Examples:
1) A broken belt.
2) Loss of air flow.
3) Loss of motor.

2.13 FAN (Control Method Thermostat)

A. General: These are general duty fans which operate to limit space temperature. Refer to the Fan schedule on Drawing M0.2 for fan information.

B. Occupied/Unoccupied:

1. During unoccupied and occupied operation, the fan shall be enabled. If the space temperature sensor exceeds its adjustable set point (initially 78F), then the intake and backdraft dampers shall be opened and fan shall start. The fan shall operate until space temperature reaches 10F below set point, and the fan shall turn off.

C. Fan failure alarm:

1. If the fan fails to start (as sensed by its current sensing relay) an alarm shall be sent to the head end identifying the fan and stating that is has failed to start.

2.14 TOXIC AND COMBUSTIBLE GAS DETECTOR SYSTEM

A. The vehicle sallyport will be equipped with a carbon monoxide sensor and the control sequence is specified under this section. In general the vehicle sallyport system will energize the space fan when the first level of alarm is reached. The space fan is also energized based on space temperature sensor per control sequence outlined for fan control by space temperature in this specification (fan control from space temperature sensor).

B. Carbon Monoxide Sensor:

1. Up to 10,000 square feet of protection.
2. Resolution: 0.5 ppm.
3. Range: 0-200 ppm.
4. Alarm A: 25 ppm, energize fan serving space.
5. Alarm B: 75 ppm, send signal for alarm to the BAS, fan continues to operate.
6. Fan is de-energized when CO levels fall below 10 ppm.
7. Mounting Height: 60" above finished floor.

2.15 DOMESTIC HOT WATER TEMPERATURE

A. The BAS shall monitor the temperature of the domestic hot water systems (temperature of water leaving the thermostatic mixing valve assembly) and shall issue an alarm to the head end if the temperature is more than 10° (adjustable) above or below set point. Alarm shall be disabled during unoccupied time periods (when domestic hot water circulating pump is off) and shall be enabled 15 minutes (adjustable) after occupancy.

B. Initial set points:
1. Temperature setting: 140 °F

C. Trending:

1. Temperature readings shall be saved every 5 minutes for 30 days.
2. With in the data set created above, the 5 highest and 5 lowest readings shall be saved monthly for 5 years.
3. With in the data set created above, the 5 highest and 5 lowest readings shall be saved annually for the life of the building.

2.16 DOMESTIC HOT WATER CIRCULATING PUMP

A. Initial set points:

1. Occupied hours: Pump on.
2. Unoccupied hours: Pump off.

B. During occupied and unoccupied hours the BAS shall command the pump to set point. A separate schedule should be adjustable at the head end graphics to vary circulating pump operation hours.

2.17 FIRE ALARM MONITORING

A. The BAS shall monitor a set of dry contacts on the fire alarm system. When the fire alarm system issues an alarm, it shall be forwarded to the BAS head end. Provide a graphic with the alarm status on the head end graphics.

2.18 EMERGENCY GENERATOR MONITORING

A. The BAS shall monitor a set of contacts on the emergency generator to monitor its status. Generator status shall be indicated on the head end graphics. If the generator is operating, the BAS graphics shall indicate such on the head end graphics.

2.19 ELEVATOR SUMP MONITORING:

A. The BAS shall monitor a set of alarm contacts from the elevator sump pump control panel. When an alarm is issued, it shall be forwarded to the head-end. If the sump pump does not include alarm contacts, the BAS shall monitor a water level sensor installed in the sump.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

1.3 Hydronic piping, components, and installation shall be capable of withstanding 150 psig at 200 degrees F.

1.4 BUILDING AUTOMATION SYSTEM COORDINATION:

A. Whether or not indicated, all wells, valves, taps, dampers, flow stations, etc. furnished under section "Building Automation System" shall be installed under this section.

1.5 SUBMITTALS

A. Pre-submittal meeting: The contractor performing work under this section of the specifications shall attend a meeting for the purpose of coordinating with the control system. The meeting shall be held on the project site in the contractor's trailer or other location acceptable to the contractor. The contractor shall be responsible for arranging the meeting. Submittals shall be essentially complete at the time of the meeting so detailed coordination items can be discussed.

B. Product Data: For each type of the following:

1. Pressure-seal fittings.
2. Valves-Include flow and pressure drop curves/information based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow control valves.
3. Air control devices.
4. Chemical treatment.
5. Hydronic specialties.

C. Maintenance Data: For hydronic specialties, balancing valves, automatic flow control valves, and special-duty valves to include in maintenance manuals.

D. Water Analysis:

1. Submit a copy of the water analysis to the architect, and the manufacturer providing water treatment services to illustrate water quality available at project site.

2. Provide a letter from the manufacturer confirming that the water quality is suitable for use with water treatment equipment.

3. At a minimum test for:
   a. PH: _____
   b. Conductivity (µS/cm): _____
   c. Total Hardness (mg/L as CaCO3): _____
   d. Calcium Hardness (mg/L as CaCO3): _____
   e. Magnesium Hardness (mg/L CaCO3): _____
   f. Alkalinity (mg/L CaCO3): _____
   g. Chloride (mg/L as Cl-): _____
   h. Silica (mg/L as SiO2): _____

1.6 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1.7 COORDINATION

A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Penetration Firestopping Systems" for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

1. Manufacturers:

E. Wrought-Copper Unions: ASME B16.22.

F. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

G. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

H. Mechanically formed outlets:

1. Manufacturers:
   a. T-Drill

2. Mechanically formed outlets shall be perpendicular to the axis of the run tube (header). They shall be formed by drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the branch wall.

3. The inner branch tube end shall conform to the shape of the inner curve of the run tube. Insertion of the branch tube shall be controlled to assure alignment with specified depth into the collar without extending into the flow stream so as to provide internal reinforcement to the collar.

4. Branches can be formed up to the run tube size as shown in ASTM F 2014. Forming procedures shall be in accordance with the tool manufacturer's recommendations.

5. All joints shall be brazed.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless) or Type F (furnace-butt welded), Grade B, Schedule 40, black steel, plain ends.

B. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, black steel, plain ends.

C. Steel Pipe, NPS 14 through NPS 18: ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 30, black steel, plain ends.

D. Steel Pipe, NPS 20: ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 20, black steel, plain ends.

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.

E. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.

F. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.

G. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

H. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.

I. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

J. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

K. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

L. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.

M. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

N. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.4 PLASTIC PIPE AND FITTINGS

A. CPVC Plastic Pipe: ASTM F 441, Schedules 40 and 80, plain ends.

B. PVC Plastic Pipe: ASTM D 1785, Schedules 40 and 80, plain ends.

C. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.

1. CPVC Solvent Cement: ASTM F 493.

D. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

1. PVC Solvent Cement: ASTM D 2564.

2.5 VALVES

A. Valves are specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Refer to Part 3 "Valve Applications" Article for applications of each valve.

C. Calibrated Balancing Valves:

1. Available Manufacturers:
   a. NIBCO
   b. Armstrong Pumps, Inc.
   c. Flow Design, Inc.
   d. Griswold Controls.
   e. ITT Bell & Gossett; ITT Fluid Technology Corp.
   f. NuTech Hydronic Specialty Products
   g. Taco, Inc.

2. NPS 2 and Smaller: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

3. NPS 2-1/2 and Larger: Cast-iron or steel body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having flanged or grooved connections. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

D. Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown, and noncorrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.

E. Pressure Relief Valves and Temperature & Pressure Relief Valves:

1. Available Manufacturers
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Conbraco Industries, Inc.
   d. ITT McDonnell & Miller Div.; ITT Fluid Technology Corp.
   e. Kunkle Valve Division.
   f. NuTech Hydronic Specialty Products
   g. Spence Engineering Company, Inc. Pressure-Reducing Valves:
   h. Watts Industries, Inc.; Watts Regulators.

2. Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.

F. Automatic Flow-Control Valves:

1. Manufacturers:
   a. Bell & Gossett
   b. Flow Design, Inc.
   c. Griswold Controls
   d. Hays Fluid Controls
   e. NuTech Hydronic Specialty Products
   f. Pro Hydronic Specialties

2. Factory set to maintain constant flow with plus or minus 10 percent over system pressure fluctuations. Each valve shall have an identification tag attached by chain, and be factory marked with the zone or equipment identification, valve number, and flow rate. Valve shall be line size and as follows:
   a. Gray-iron or brass body, designed for 175 psig at 200 deg For; brass or ferrous-metal body, designed for 300 psig at 250 deg F.
   b. Stainless steel or nickel chrome plated brass, tamperproof, self-cleaning, piston-spring assembly, or polyphenylsulfone orifice seat with polymer diaphragm (Hays) easily removable for inspection or replacement.
   c. "Y" or other configuration permitting cartridge replacement without valve removal for sizes 2" and smaller.
   d. Unions and isolation valves or other configuration permitting cartridge replacement with valve removal for sizes larger than 2".
   e. Flow and pressure differential adjustable by cartridge replacement.
   f. Minimum pressure differential shall not exceed 2 psi. (Unless otherwise indicated)
   g. Maximum pressure differential shall not be less than 32 psi. (Unless otherwise indicated)
   h. Flow rates shall be as indicated on equipment schedules on the drawings.
   i. Valves shall be installed in return piping.
   j. Ball valves and unions included as part of a valve package may be used in place of ball valves and unions specified and indicated on the drawings only when in positions indicated. Ball valves shall be provided with a solid stainless steel ball.
   k. Provide a #20 mesh Y-strainer with blow-down valve and garden hose connection between the supply side valve and equipment
   l. Valves may be provided as part of a "hose kit" and are exempt from the requirements of section "General Duty Valves for HVAC Piping".

2.6 AIR CONTROL DEVICES

A. Available Manufacturers:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. NuTech Hydronic Specialty Products

5. Taco.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2
5. Discharge Connection: NPS 1/8
6. CWP Rating: 150 psig
7. Maximum Operating Temperature: 225 deg F

C. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.

2.7 HYDRONIC PIPING SPECIALTIES

A. Compression/Expansion Tanks:

1. Available Manufacturers:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. ITT Bell & Gossett; ITT Fluid Technology Corp.
   d. Taco, Inc.
2. Welded carbon steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Separate air charge from system water to maintain design expansion capacity by a flexible diaphragm securely sealed into tank. Include drain fitting and tap for air-charging fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Factory fabricate and test tank with taps and supports installed and labeled according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
3. Charge: Charge tank without applying system pressure to a pressure equal to that indicated for the domestic cold water makeup pressure reducing valve.

B. Air Separators:

1. Available Manufacturers
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. ITT Bell & Gossett; ITT Fluid Technology Corp.
   d. Taco, Inc.
2. Tangential-Type Air Separators: Welded black steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature; perforated stainless-steel air collector tube designed to direct released air into expansion tank; tangential inlet and outlet connections; threaded connections for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger; threaded blowdown connection. Provide units in sizes for full-system flow capacity.

C. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.

D. Basket Strainers: 125-psig working pressure; high-tensile cast-iron body (ASTM A 126, Class B), flanged-end connections, bolted cover, perforated stainless-steel basket, and bottom drain connection.

E. T-Pattern Strainers: 750-psig working pressure; ductile-iron or malleable-iron body, grooved-end connections, stainless-steel basket with 57 percent free area; removable access coupling and end cap for strainer maintenance.

F. Flexible Connectors:

1. Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged- or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

2. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.

3. Combinations of grooved mechanical-joint couplings and short nipples when installed per instructions from Victaulic Company of America.

G. Pressure temperature test (P/T) port

1. Manufacturers:
   a. NuTech Hydronic Specialty Products
   b. Petersen
   c. Sisco Manufacturing Co.
   d. Omega
   e. Watts Water Technologies, Inc.
2. Body: Brass.
3. Core: Nordel
4. Cap: Brass
5. Provide extension to allow insulation installation.

2.8 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

B. Propylene Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain antifreeze or glycol solutions.

C. Glycol Feed System:
   1. Manufacturers: Advantage Controls, Eaton or Neptune
   2. Description: A glycol feeder designed to maintain consistent pressure in closed loop systems automatically feeding pre-mixed glycol based on system pressure. Frame with mixer bracket, tank, prewired controller, low level cut-off alarm and pre-plumbed piping assembly with pressure gauge, pressure sensor, back check and relief valve.
   3. Tank: 50-55 gallon polyethylene
   4. Stand: Painted steel frame with mixer bracket and mixer
   5. Piping: Carbon steel rated at 100 PSI
   6. Pump: 1.5 GPM at 100 PSI; 1/3 HP
   7. Controls: Analog with indicator lights, mechanical 5-20 PSI adjustable pressure switch, audible alarm, dry contact level alarm and a NEMA 4X high impact thermoplastic enclosure with pad lockable gasketed Lexan viewing door.
   8. Volume: 50-55 gallons.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Heating Hot Water, & Chilled Water 2" and Smaller:
   1. Aboveground shall be either:
      a. Type L drawn-temper copper tubing with wrought-copper fittings and soldered joints.
      b. Schedule 40 steel pipe with wrought steel fittings and wrought cast or forged steel flanges and flange fittings or welded and flanged joints.
   2. Belowground and below slabs:
      a. Type L drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Heating Hot Water, & Chilled Water 2-1/2" and Larger:
   1. Inside building and aboveground:
      a. Schedule 40 steel pipe with welded and flanged joints or Type L drawn-temper copper tubing with soldered joints.
   2. Belowground and below slabs:
      a. Direct bury pre-insulated pipe system with same pipe material as inside the building.

C. Chilled Water 2-1/2" and Larger Outside Building: As specified for Inside Building,

D. Make-up Water 2" and Smaller: Type L drawn-temper copper tubing with wrought-copper fittings, and soldered joints.

E. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints

F. Air-Vent Piping:

1. Inlet: Same as service where installed.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

G. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

H. Miscellaneous: Same materials and joining methods as connecting service.

3.2 FITTING APPLICATIONS

A. Fitting Options:

1. Mechanically formed tee-branch outlets (T-Drill) and brazed joints may be used on aboveground copper tubing.

3.3 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

1. Shutoff Duty: Ball, and butterfly valves.
2. Throttling Duty: Ball, and butterfly valves.

B. Install shutoff duty valves at each branch connection to supply mains, unless only one piece of equipment is connected in the branch lines, and at supply connections to each piece of equipment. Install automatic flow control valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.

C. Install Automatic Flow Control Valves in the return water line of each heating or cooling element, each piece of equipment, and as indicated.

D. Install check valves at each pump discharge and elsewhere to control flow direction.

E. Install safety valves on hot-water generators and as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping without valves. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

F. Install pressure-reducing valves on makeup water piping to regulate system pressure.

3.4 PIPING INSTALLATIONS

A. Install all wells, valves, taps, flow stations, etc. furnished under Division 25 Section "Building Automation System".

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

D. Install exterior piping at a uniform grade of 0.2 percent upward in direction of flow. Interior piping may be installed level.

E. Install condensate drain piping at a minimum uniform slope of 1" in 10'-0"in the direction of flow.

F. Reduce pipe sizes using concentric reducers, or eccentric reducers installed with level side up.

G. Provide branch connections with the takeoff coming off the top of the main with dog leg.

H. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and as indicated. Install ¾" diameter by 8" long nipple and ball valve in blowdown connection of strainers ¾" and larger. Match size of strainer blowoff connection for strainers smaller than ¾".

I. Install piping in concealed locations.

1. Exceptions:
    a. Equipment rooms.
    b. Fan rooms.
    c. Mechanical Rooms.
    d. Loading Docks.
    e. Storage Rooms.
    f. Where indicated on the contract drawings to be exposed.

J. Install piping above accessible ceilings allowing sufficient space for removal of ceiling panels.

K. Install piping to permit servicing of valves.

L. Install piping free of sags.

M. Install fittings for changes in direction and branch connections.

N. Install piping with 6" clear all around.

O. Select system components with pressure rating equal to or greater than system operating pressure.

P. Install groups of pipes parallel to each other.

Q. Install drains, consisting of a tee fitting, ¾" by 8" long nipple, ball valve, and cap, at low points in piping system mains and elsewhere for system drainage.

R. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

S. Install unions in piping, 2" and smaller, adjacent to valves, at final connections of equipment, and as indicated.

T. Install flanges in piping, NPS 2-1/2" and larger, at final connections of equipment and as indicated.

U. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

V. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

Y. Install escutcheons for exposed piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

Z. Provide seal around piping penetrations of full height interior walls, both rated and non-rated, that occur above ceilings. Refer to Section 079200 Joint Sealants.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are damaged.
3. Damaged Welds: Do not use pipe sections that have cracked or open welds.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.

H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool, procedure, and brazed joints.

1. Mechanically Formed Outlets: Form tee in copper tube according to equipment manufacturer's written instructions. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.6 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports.

B. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. ¾": Maximum span, 7'-0"; minimum rod size, ¼".
2. 1": Maximum span, 7'-0"; minimum rod size, ¼".
3. 1½": Maximum span, 9'-0"; minimum rod size, 3/8".
4. 2": Maximum span, 10'-0"; minimum rod size, 3/8".
5. 2½": Maximum span, 11'-0"; minimum rod size, 3/8".
6. 3": Maximum span, 12'-0"; minimum rod size, 3/8".
7. 4": Maximum span, 14'-0"; minimum rod size, ½".
8. 6": Maximum span, 17'-0"; minimum rod size, ½".
9. 8": Maximum span, 19'-0"; minimum rod size, 5/8".
10. 10": Maximum span, 20'-0"; minimum rod size, ¾".
11. 12": Maximum span, 23'-0"; minimum rod size, 7/8".
12. 14": Maximum span, 25'-0"; minimum rod size, 1".
13. 16": Maximum span, 27'-0"; minimum rod size, 1".
14. 18": Maximum span, 28'-0"; minimum rod size, 1¼".
15. 20": Maximum span, 30'-0"; minimum rod size, 1¼".

C. Install hangers for copper piping with the following maximum spacing and minimum rod sizes:

1. ¾": Maximum span, 5'-0"; minimum rod size, ¼".
2. 1": Maximum span, 6'-0"; minimum rod size, ¼".
3. 1½": Maximum span, 8'-0"; minimum rod size, 3/8".
4. 2": Maximum span, 8'-0"; minimum rod size, 3/8".
5. 2½": Maximum span, 9'-0"; minimum rod size, 3/8".

6. 3": Maximum span, 10'-0"; minimum rod size, 3/8".

D. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

3.7 Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.8 Where changes in direction or tees occur, place hangers 1/3 of the maximum allowed spacing distance from the change in direction or tee (i.e. if the maximum span is 12 feet, the hanger shall be 4 feet from the change in direction or tee). Pipe shall be supported from both sides of a change in direction.

3.9 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at coils, and elsewhere as required for system air venting.

B. Install automatic air vents in mechanical equipment rooms only at high points of system for air venting and at air separators.

C. Install in-line air separators in pump suction lines. Install piping to compression tank with a 2 percent minimum upward slope toward tank.

1. Install drain valve on units NPS 2 and larger.

D. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above floor. Install feeder in bypass line, off main, using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.

E. Install expansion tanks on floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system design requirements.

3.10 EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall match existing pipe size or equipment connection size or as indicated on the drawings, whichever is greater.

B. Install control valves in accessible locations near connected equipment.

C. Install ports for pressure and temperature gages at equipment and coil inlet and outlet connections.

3.11 CHEMICAL TREATMENT

A. Flush system with fresh clear water until it drains clear.

B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

C. Provide initial water treatment.

3.12 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during testing.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test.
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.13 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Check pump for proper direction of rotation.
3. Set automatic fill valves for required system pressure.
4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils and equipment are calling for full flow.
6. Check and set equipment operating temperatures to design requirements.
7. Lubricate motors and bearings.

3.14 CLEANING

A. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers.

END OF SECTION 232131

SECTION 232123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Product Data:

1. Provide certified performance curves, rated capacities, final impeller dimensions, and operating weights of proposed pumps. Indicate pump operating points on curves.
2. Provide specialties, and accessories for each type of product indicated.

B. Maintenance Data:

1. Provide maintenance manuals for pumps.

1.3 QUALITY ASSURANCE

A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.

B. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on the specific types and models indicated. Pumps manufactured by listed manufacturers with equal performance characteristics may be considered. Refer to Instructions To Bidders.

C. Regulatory Requirements: Fabricate and test steam condensate pumps to comply with HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation," and HI 1.6, "Centrifugal Pump Tests."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: One set for each pump.

PART 2 - PRODUCTS

2.1 GENERAL PUMP REQUIREMENTS

A. Pumps: Factory assembled and tested centrifugal.

B. Manufacturer

C. Motors: Meet requirements of section "MOTORS FOR HVAC EQUIPMENT"

2.2 FLEXIBLE COUPLED END SUCTION

A. Manufacturers:

1. Armstrong Pumps, Inc.
2. Bell & Gossett ITT; Div. of ITT Fluid Technology Corp.
3. PACO Pumps.
4. Taco; Fabricated Products Div.

B. Description: Base-mounted, centrifugal, flexible-coupled, end-suction, single-stage, bronze-fitted, back-pull-out, radially split case design; rated for 175 PSIG minimum working pressure and a continuous water temperature of 225° F.

1. Casing: Cast iron, with flanged piping connections, drain plug at low point of volute, threaded gage tappings at inlet and outlet connections, and integral feet or other means on volute to support weight of casing and attached piping. Casing shall allow removal and replacement of impeller without disconnecting piping.
2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, keyed to shaft, and secured by locking cap screw.
3. Shaft and Sleeve: Steel shaft with bronze sleeve.

4. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
5. Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
6. Coupling Guard: Steel, removable, and attached to mounting frame.
7. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate for mounting pump casing, coupling guard, and motor. Field-drill motor-mounting holes for field-installed motors.
8. Motor: Secured to mounting frame, with adjustable alignment. Where variable speed pumping is required pump motor shall be suitable for use with variable speed drive.

2.3 AUTOMATIC CONDENSATE PUMP UNITS

A. Manufacturers:

1. Beckett Corp.
2. Hartell Div.; Milton Roy Co.
3. Liberty Pumps
4. Little Giant Pump Co.
5. Marsh Manufacturing, Inc.

B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Provide factory- or field-installed check valve and a 72-inch- minimum, electrical power cord with plug.

2.4 PUMP SPECIALTY FITTINGS

A. Suction Diffuser: Angle or straight pattern, 175 PSIG pressure rating, cast iron body and end cap, pump-inlet fitting; with bronze startup strainer and bronze or stainless steel permanent strainer. Provide bronze or stainless steel straightening vanes, drain plug, and factory or field fabricated support.

B. Silent Check Valve:

1. Wafer style, class 125 PSIG non-shock cold working pressure, iron body, spring actuated, renewable Buna-N bonded to bronze seat, bronze disk, stainless steel spring, and stainless steel set screw.
2. Twin disc wafer style, class 125 psi non-shock cold working pressure, iron body, spring actuated, Buna-N seat, bronze disk, stainless steel spring, stainless steel hinge and stop pins, stainless steel thrust bearing, and steel hinge pin and stop pin retainers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation.

1. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
2. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Install pumps according to manufacturer's written instructions.

B. Install pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.

C. Support pumps and piping separately so piping is not supported by pumps. Inline pumps may be supported by piping only when in accordance with manufacturer's installation instructions.

D. Suspend in-line pumps using continuous-thread hanger rod and vibration-isolation hangers. Install seismic bracing as required by authorities having jurisdiction.

E. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.

3.3 ALIGNMENT

A. The following is required for horizontal flexible coupled shafts:

1. Align pump and motor shafts and piping connections after setting them on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made.
2. Comply with pump and coupling manufacturers' written instructions.
3. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."
4. After alignment is correct, tighten foundation bolts evenly without altering alignment. Completely fill base with non shrink nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping to allow service and maintenance.

C. Install electrical connections for power, controls, and devices.

D. Electrical power and control wiring and connections are specified in Division 26 Sections.

E. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 COMMISSIONING

A. Verify that pumps are installed and connected according to the Contract Documents.

B. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents.

C. Perform the following preventive maintenance operations and checks before starting:

1. Lubricate bearings.
2. Disconnect coupling and check motor for proper rotation that matches direction marked on pump casing.
3. Verify that pumps are free to rotate by hand and that pumps for handling hot liquids are free to rotate with pumps hot and cold. Do not operate pumps if they are bound or drag.
4. Check piping connections for tightness and leaks. Do not operate pumps with loose or leaking piping connections.
5. Clean strainers.
6. Verify that pump controls are in compliance with contract documents.

D. Starting procedure shall be as recommended by manufacturer. If manufacturer chooses not to provide recommendations the starting procedure shall be as follows:

1. Ensure shafts have been aligned where applicable.
2. Prime pumps by opening suction valves and closing drains.
3. Open cooling water supply valves in cooling water supply to bearings, where applicable.
4. Open sealing liquid-supply valves if pumps are so fitted.
5. Open warm-up valves of pumps handling hot liquids if pumps are not normally kept at operating temperature.
6. Open suction valves.
7. Start motors.
8. Open discharge valves slowly.
9. Observe leakage from stuffing boxes and adjust sealing liquid valve for proper flow to ensure lubrication of packing. Let packing "run in" before reducing leakage through stuffing boxes; then tighten glands.
10. Check general mechanical operation of pumps and motors.
11. Close circulating line valves once there is sufficient flow through pumps to prevent overheating.

E. Refer to Division 23 Section "TESTING, ADJUSTING, AND BALANCING FOR HVAC" to obtain detailed requirements for testing, adjusting, and balancing of hydronic systems.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
2. Review data in maintenance manuals.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 232123

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated for the following:
   1. Thermostatic expansion valves.
   2. Solenoid valves.
   3. Hot-gas bypass valves.
   4. Filter dryers.
   5. Strainers.
   6. Pressure-regulating valves.

B. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.3 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX; "Welding and Brazing Qualifications."

B. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

C. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."

D. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

1.5 COORDINATION

A. Coordinate layout and installation of refrigerant piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for wall penetrations.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

D. Coordinate pipe sleeve installations for penetrations in exterior walls and floor assemblies. Coordinate with requirements for firestopping.

E. Coordinate pipe fitting pressure classes with products specified in related Sections.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:
1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum ¾" misalignment in minimum 7" length.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.

B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.

C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Flanged Unions:

1. Body: Forged-steel flanges for 1" to 1 ½" and ductile iron for 2" to 3". Apply rust-resistant finish at factory.
2. Gasket: Fiber asbestos free.
3. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
4. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
5. Offset Performance: Capable of minimum ¾" misalignment in minimum 7" length.
6. Pressure Rating: Factory test at minimum 400 psig.
7. Maximum Operating Temperature: 330 deg F.

F. Flexible Connectors:
1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
2. End Connections:

a. NPS 2 and Smaller: With threaded-end connections.
b. NPS 2-1/2 and Larger: With flanged-end connections.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:
1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:
1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:
1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.

5. End Connections: Socket, union, threaded, or flanged.
6. Maximum Opening Pressure: 0.50 psig.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

D. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 or UL 429.
1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24, 115, or 208-V ac coil to meet requirements of control system.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat Disc: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig.
6. Maximum Operating Temperature: 240 deg F.

G. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F.
6. Superheat: Adjustable.
7. Reverse-flow option for heat-pump applications.
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 450 psig.

H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
5. Seat: Polytetrafluoroethylene.
6. Equalizer: Internal or External.

7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24, 115, or 208-V ac coil to meet requirements of control system.
8. End Connections: Socket.
9. Throttling Range: Maximum 5 psig.
10. Working Pressure Rating: 500 psig.
11. Maximum Operating Temperature: 240 deg F.

I. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

J. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

K. Moisture/Liquid Indicators:
1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

L. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow when used in for heat-pump applications.
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Rated Flow: Match equipment.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

M. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.

3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow where heat-pump applications are indicated.
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig Insert value.
8. Rated Flow: Match equipment.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

N. Mufflers:
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

O. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

A. Available Manufacturers:
1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-134a: Tetrafluoroethane.

C. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.

D. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT

A. Suction Lines 1 ½" and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Suction Lines 2" to 4" for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Hot-Gas, and Liquid Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

E. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints or soldered joints or Schedule 40, black-steel and wrought-steel fittings with welded joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless, or packed-angle valves in suction and discharge lines of compressors.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of proposed equipment.

C. Install a check valve at the compressor discharge and a liquid accumulator. Locate at the compressor suction connection between the compressor and service valve.

D. Unless indicated otherwise, install valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve on systems with multiple thermostatic expansion valves. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
   1. Install valve so diaphragm case is warmer than bulb.
   2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line. Verify proper location with Equipment Manufacturer.
   3. Where external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following:
   1. Solenoid valves.
   2. Thermostatic expansion valves.
   3. Hot-gas bypass valves.
   4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.3 VALVE APPLICATIONS

3.4 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless or packed-angle valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve on systems with multiple thermostatic expansion valves. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Verify proper location for bulb with valve manufacturer. Don't mount bulb in a trap or at bottom of line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at inlet of the thermostatic expansion valve or at inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished with equipment:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryer in liquid line between compressor and thermostatic expansion valve.

L. Install filter dryer in the suction line at the compressor.

3.5 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, & packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Identify refrigerant piping and valves according to Section "Identification for HVAC Piping and Equipment."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

T. Install sleeve seals for piping penetrations of exterior walls and floor slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for HVAC Piping."

3.6 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.7 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20'-0" long.
2. Roller hangers and spring hangers for individual horizontal runs 20'-0" or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20'-0" or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. ½": Maximum span, 60"; minimum rod size, ¼".
2. 5/8": Maximum span, 60"; minimum rod size, ¼".
3. 1": Maximum span, 72"; minimum rod size, ¼".
4. 1 ¼": Maximum span, 96"; minimum rod size, 3/8".
5. 1 ½": Maximum span, 96"; minimum rod size, 3/8".
6. 2": Maximum span, 96"; minimum rod size, 3/8".
7. 2 ½": Maximum span, 108"; minimum rod size, 3/8".

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. 2": Maximum span, 10'-0"; minimum rod size, 3/8".
2. 2 ½": Maximum span, 11'-0"; minimum rod size, 3/8".

E. Support multifloor vertical runs at least at each floor.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.9 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.10 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

A. Seal all ducts to seal class A as defined in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005:

1. Seal all longitudinal joints.
2. Seal all transverse joints.
3. Seal all penetrations.

B. Seal Class: A

C. Test pressure:

1. 3.0" WC for round and flat oval duct, but not to exceed pressure of duct construction.
2. 6.0" WC for rectangular duct, but not to exceed pressure of duct construction.
3. Un-tested: NA

D. Testing: Leak test 20% of all ductwork including supply air, exhaust air, return air, and outside air.

E. Duct Construction: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005" and performance requirements and design criteria indicated in "Duct Schedule" Article.

F. Liner Airstream Surfaces: Liner surfaces in contact with the airstream shall comply with ASHRAE 62.1-2007, paragraph 5.5.

G. CLEANLINESS: All factory fabricated duct shall be cleaned with a non-toxic, biodegradable cleaner/degreaser and shall be shrink wrapped prior to shipment.

H. Structural Performance: Smoke removal duct hangers, supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005 and ASCE/SEI 7.

1.3 ABBREVIATIONS

A. BAS Building Automation System

B. NRTL Nationally Recognized Testing Laboratory

C. SMACNA Sheet Metal and Air conditioning Contractors' National Association

D. WC Water Column

1.4 DEFINITIONS:

A. Duct System: For the purposes of this section "duct system" shall mean all metal supply, return, and exhaust duct and fittings between the air moving device and the space.

B. Low Pressure: Plus two (2.0) inches WC to minus one (1.0) inches WC

C. Medium Pressure: More than two (2.0) inches WC to plus ten (10.0) inches WC or more than minus one (1.0) inch to minus ten (10.0) inches WC

D. High Pressure: More than plus or minus ten(10.0) inches WC.

1.5 SUBMITTALS

A. Product Data / Documentation: For each of the following:

1. Sheet metal thicknesses.
2. Liners and adhesives.
3. Pre-manufactured ductwork.
4. Sealants and gaskets.
5. Statement of duct seal class. Describe how it will be achieved.
6. VOC content for adhesives and sealants.
7. Seismic-restraint devices.

B. CAD-generated Shop Drawings:

1. Show fabrication and installation details for metal ducts.
2. 1/4"=1'-0" scale minimum including duct layout indicating sizes and pressure classes for the following areas:
   a. Finished spaces with exposed ductwork.
      1) Exceptions:
         a) Janitors closets
         b) Storage Rooms
         c) Receiving Areas
      2) Include:
         a) Plans, elevations and sections.
         b) Elevations of top and bottom of ducts.
         c) Dimensions of main duct runs from building grid lines.
3. 3/4"=1'-0" scale minimum for the following:
   a. Hangers and supports, including methods for duct and building attachment, vibration isolation and seismic restraints.
   b. Duct accessories, including access doors and panels.
   c. Equipment installation based on approved equipment submittals.
   d. Penetrations through fire-rated and other partitions.
   e. Fittings.
   f. Components.
4. 3"=1'-0" scale minimum for the following:
   a. Seam and joint construction.
   b. Reinforcement and spacing.
   c. Fabrication including attachments to other work.
   d. Trapeze Hangers.

e. Mockups may be provided in lieu of 3"= 1'-0" details. Notify Architect in writing if mock-ups will be provided

C. Submittals during construction:

1. Leakage Test Report: Documentation of work performed for compliance with ASHRAE/IESNA 90.1-2007, Section 6.4.4.2.2 - "Duct Leakage Tests."
2. Duct-Cleaning Test Report: Documentation of work performed for compliance with ASHRAE 62.1-2007, Section 7.2.4 - "Ventilation System Start-Up."

1.6 QUALITY ASSURANCE

A. Provide work in compliance with applicable Building Code requirements.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

C. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

D. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.

E. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

F. ASHRAE Compliance: Comply with applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

G. ASHRAE/IESNA Compliance: Comply with applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6.4.4 - "HVAC System Construction and Insulation."

H. Mockups (Contractor's option in lieu of 3"=1'-0" details):

1. Before installing duct systems, build mockups. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
2. Three transverse joints.
3. One Reinforced section with 3 reinforcements.
4. One of each type; attachments to other work.
5. Two typical flexible duct or flexible-connector connections.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 2-1, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 2-2, "Rectangular Duct/Longitudinal Seams" for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005."

2.2 LOW PRESSURE SINGLE-WALL ROUND DUCTS AND FITTINGS –CONCEALED

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Chapter 3, "Round, Oval, and Flexible Duct," based on specified static-pressure class unless otherwise indicated.

B. Manufacturers:

1. Eastern Sheet Metal.
2. Lindab Inc.
3. McGill AirFlow LLC.
4. Performance Duct Systems
5. Spiral Manufacturing Co., Inc.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-1, "Round Duct Transverse Joints"

1. Transverse Joints in Ducts Equal to or Larger Than 48" in Diameter: Flanged.
2. Gasketed, EPDM, self sealing Joints such as Eastern Tight or Spiro Safe may be used for ducts smaller than 48" in diameter.
3. Flanges may be substituted in ducts smaller than 48" in diameter.

D. Duct support intervals, and other provisions: In accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005."

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005."

F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-5, "90º Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005." Adjustable elbows are not permitted.

G. All seam types in FIGURE 3-2 are acceptable where approved by SMACNA.

2.3 MEDIUM PRESSURE SINGLE-WALL ROUND AND FLAT OVAL DUCTS AND FITTINGS –CONCEALED

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Manufacturers:

1. Eastern Sheet Metal.
2. Lindab Inc.
3. McGill AirFlow LLC.
4. Performance Duct Systems
5. Spiral Manufacturing Co., Inc.

C. Flat-Oval Ducts: Dimensions are the inside duct width (major dimension) and inside diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-1, "Round Duct Transverse Joints"

1. Transverse Joints in Ducts Equal to or Larger Than 48" in Diameter: Flanged.
2. Gasketed, EPDM, self sealing Joints such as Eastern Tight or Spiro Safe may be used for ducts smaller than 48" in diameter.
3. Flanges may be substituted in ducts smaller than 48" in diameter.

E. Duct support intervals, and other provisions: In accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005."

F. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005."

G. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-5, "90º Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005." Adjustable elbows are not permitted.

H. All seam type in FIGURE 3-2 are acceptable where approved by SMACNA.

2.4 LOW PRESSURE SINGLE-WALL ROUND DUCTS AND FITTINGS -EXPOSED

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Chapter 3, "Round, Oval, and Flexible Duct," "FIGURE 3-2 ROUND DUCT LONGITUDINAL SEAMS" "SPIRAL SEAM RL-1" to plus-or-minus 10" WC unless otherwise indicated.

B. Manufacturers:

1. Eastern Sheet Metal.

2. Lindab Inc.
3. McGill AirFlow LLC.
4. Performance Duct Systems
5. Spiral Manufacturing Co., Inc.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-1, "Round Duct Transverse Joints"

D. Static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005." And the following:

1. Transverse Joints in Ducts Equal to or Larger Than 48" in Diameter or Flat Oval With a Major Dimension Equal to or Larger Than 48": Flanged.
2. Gasketed, EPDM, self sealing Joints such as Eastern Tight or Spiro Safe may be used for ducts smaller than 48" in diameter.
3. Flanges may be substituted in ducts smaller than 48" in diameter.

E. Longitudinal Seams: Duct shall be spiral according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-2, " Round Duct Longitudinal Seams"

F. Tees and Laterals: Tees and laterals shall be created with fittings. Fabricate fittings according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005." Adjustable elbows are not permitted.

G. Static-pressure class: , applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005."

H. Longitudinal seams shall be spiral type.

2.5 MEDIUM PRESSURE SINGLE-WALL ROUND AND FLAT OVAL DUCTS AND FITTINGS -EXPOSED

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Chapter 3, "Round, Oval, and Flexible Duct," "FIGURE 3-2 ROUND DUCT LONGITUDINAL SEAMS" "SPIRAL SEAM RL-1" to plus-or-minus 10" WC unless otherwise indicated.

B. Manufacturers:

1. Eastern Sheet Metal.
2. Lindab Inc.
3. McGill AirFlow LLC.
4. Performance Duct Systems
5. Spiral Manufacturing Co., Inc.

C. Flat-Oval Ducts: Dimensions are the inside duct width (major dimension) and inside diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-1, "Round Duct Transverse Joints"

E. Static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005." And the following:

1. Transverse Joints in Ducts Equal to or Larger Than 48" in Diameter or Flat Oval With a Major Dimension Equal to or Larger Than 48": Flanged.
2. Gasketed, EPDM, self sealing Joints such as Eastern Tight or Spiro Safe may be used for ducts smaller than 48" in diameter.
3. Flanges may be substituted in ducts smaller than 48" in diameter.

F. Longitudinal Seams: Duct shall be spiral according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-2, " Round Duct Longitudinal Seams"

G. Tees and Laterals: Tees and laterals shall be created with fittings. Fabricate fittings according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005." Adjustable elbows are not permitted.

H. Static-pressure class: Applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005."

I. Longitudinal seams shall be spiral type.

2.6 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 or G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.7 DUCT LINER

A. For double wall duct: Not Required

B. All other duct: Provide where indicated.

C. Flexible Elastomeric: Conformable-closed-cell, foam- or expanded-rubber materials containing or coated with, EPA-approved or EPA-Registered anti-microbial additive or paint. Comply

with ASTM C 534, Type I, Grade 1, for sheet materials. Provide product recognized under Underwriters Laboratories "UL 94 - Plastic Component Classification".

D. Basis-of-Design Product: Armacell LLC; AP Coilflex; Sample not required, or subject to compliance with requirements, provide a comparable product by one of the following:

1. Aeroflex USA Inc.; Provide 4"x4" minimum sample.
2. Nomanko K-Flex; Provide 4"x4" minimum sample.
3. RBX Corporation; Provide 4"x4" minimum sample.

E. Adhesive & Tape: Approved by liner manufacturer.

F. Pins: Pinning or other mechanical fastening methods shall not be accepted.

2.8 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723.

1. Materials: Certified by a NRTL.

B. Tape sealing systems are not permitted.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
10. Indoor applications: Sealant with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. Indoor applications: Sealant with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.9 HANGERS AND SUPPORTS

A. Hanger Rods: Galvanized, all-thread.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.10 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Kinetics Noise Control.
5. Mason Industries.
6. TOLCO; a brand of NIBCO INC.
7. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved by Architect in writing.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005" unless otherwise indicated.

C. Install ducts with fewest possible joints.

D. Install factory-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically or horizontally, and parallel or perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Maintain clearances for equipment maintenance.

G. Install ducts with a clearance of 1 inch, plus allowance for installation of insulation at specified thickness.

H. Do not route ducts through transformer vaults, electrical equipment rooms, elevator equipment rooms or electrical enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Provide fire dampers where ducts pass through fire-rated interior partitions or fire rated exterior walls.

K. Protect duct interiors from moisture, construction debris, dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding. Do not weld or grind lined ductwork.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of duct, fittings, hangers, supports, accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal all ducts to seal class A as defined in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005:

1. Seal all longitudinal joints.
2. Seal all transverse joints.
3. Seal all penetrations.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Chapter 5, "Hangers and Supports."

B. Building Attachments: Unless indicated otherwise, provide concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Do not use powder-actuated concrete fasteners for lightweight-aggregate concrete or for slabs less than 4 inches thick.
3. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and channel supports.

E. Support vertical ducts with channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor or at a maximum intervals of 18 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Design hangers and braces to support the duct and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7 and brace changes of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

F. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, and grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Install heavy-duty sleeve anchors with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005" for branch, outlet, inlet, and terminal unit connections unless otherwise indicated.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply two coats of flat black, latex paint over a compatible galvanized-steel primer.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Visually inspect, for proper seal application, all ductwork not tested prior to insulation application. Prepare inspection report.

C. Leakage Test.

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Prepare a test report for each test.
2. Test ducts, disassemble, reassemble, reseal, and retest until leakage class 3 (as defined in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005) is achieved.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested.
6. Give seven days' advance notice to Architect and Owner for testing.

D. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct systems, up to one location per ten thousand (10,000) square feet of building area, or a minimum of two (2) per system, whichever is greater, chosen randomly by the Owner's Representative, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems." Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm. Cut hole in duct and install access door at each location selected. Size shall be as indicated in division 23 section "AIR DUCT ACCESSIRIES".
3. Duct system shall be considered dirty and in need of cleaning if any test location does not pass the cleanliness test. Cleaning shall be performed in accordance with this specification.

E. Prepare and submit test and inspection reports.

3.9 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 4-2, "Rectangular Elbows."
2. Velocity 1000 fpm or Lower:
   a. Radius Type RE 1. Centerline radius = 3W/2.
   b. Mitered Type RE 4. SMACNA Type RE 4 does not have turning vanes.
3. Velocity Greater than 1000 to 1500 fpm:
   a. Radius Type RE 1.Centerline radius = 3W/2.
   b. Radius Type RE 3 with two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
4. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-4, "Round Duct Elbows."
5. Minimum centerline radius-to-diameter ratio shall be 1.5 with a maximum of 5 Elbow Segments. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Table 3-1, "Mitered Elbows." Elbows with less than a 90 degree change of direction shall have segments per table 3-1 in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005".
6. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
7. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

C. Branch Configuration:

D. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 4-6, "Branch Connections."

1. Rectangular Main to Rectangular Branch: 45-degree entry.
2. Rectangular Main to Round Branch: Conical or bell mouth. Flanged or spin in.

E. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005," Figure 3-6, "Conical Tees."

1. Conical fitting.
2. Conical saddle taps may be used only in locations approved in writing by the architect.

END OF SECTION 233113

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Radius forming braces
2. Volume dampers.
3. Smoke control manual volume dampers.
4. Fire dampers.
5. Ceiling fire dampers.
6. Smoke dampers.
7. Combination fire and smoke dampers.
8. Turning vanes.
9. Duct-mounted access doors.
10. Flexible connectors.
11. Flexible ducts.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.3 ABBREVIATIONS

A. CFM Cubic Feet per Minute

B. F Fahrenheit

C. FPM Feet Per Minute

D. IN Inches

E. LBF Pound Feet, or Pound Foot.

F. NFPA National Fire Protection Association

G. NO Number

H. NRTL Nationally Recognized Testing laboratory

I. OC On Center

J. SqFt Square Feet

K. WC Water Column

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed. Minimum 1 of each type used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable duct installation methods unless otherwise indicated.

C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 or G90.
2. Exposed-Surface Finish: Mill phosphatized.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a NO 2 finish for concealed ducts and NO 4 finish for exposed ducts.

E. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

F. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

G. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches; compatible materials for aluminum and stainless-steel ducts.

2.2 RADIUS FORMING BRACES

A. Available manufacturers:

1. Titus, FlexRight (Basis of Design)
2. Flexible Technologies, Inc., Thermaflex Division, FlexFlow
3. Hart & Cooley, Smart Flow Elbow

B. General: UL-2043 listed or NRTL approved product constructed of metal or plastic manufactured for use with flexible duct to form a kink free elbow using the flexible duct. Any flexible duct used in forming the elbow shall be included in the maximum permitted length. Resulting flexible duct shall comply with SMACNA HVAC Duct Construction Standards.

C. Duct Size: 6" through 16" in diameter.

D. Inside (Bend) Radius: Minimum of one duct diameter along centerline.

E. Attachments: Plastic zip ties or stainless steel worm gear clamps.

F. Support to Overhead: Shall meet SMACNA requirements. Use of specified attachments for support shall not be permitted.

2.3 MANUAL VOLUME DAMPERS

A. Steel, Manual Volume Dampers:

1. Manufacturers:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. Flexmaster U.S.A., Inc.
   d. Greenheck Fan Corporation.
   e. McGill AirFlow LLC.
   f. METALAIRE, Inc.
   g. PCI Industries - Pottorff
   h. Ruskin Company.
   i. Vent Products Company, Inc.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Hat-shaped, galvanized or stainless-steel channels, match duct material.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized or stainless-steel channels, match duct material.
   e. Blade Axles: Galvanized steel or Stainless steel. Dampers over 12" width/diameter shall include continuous axles. Dampers 12" and less may have non-continuous axles.
6. Bearings:
   a. Molded synthetic. Provide bearing at both duct wall penetrations.
7. Tie Bars and Brackets: Galvanized steel.

B. Aluminum, Manual Volume Dampers:

1. Manufacturers:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. Flexmaster U.S.A., Inc.
   d. Greenheck Fan Corporation.
   e. McGill AirFlow LLC.
   f. METALAIRE, Inc.
   g. PCI Industries - Pottorff
   h. Ruskin Company.
   i. Vent Products Company, Inc.

2. Standard leakage rating, with linkage and operator outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped aluminum channels for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Roll Formed or Extruded Aluminum.
   e. Blade Axles: Galvanized steel or Stainless steel. Dampers over 12" width/diameter shall include continuous axles. Dampers 12" and less may have non-continuous axles.
6. Bearings:
   a. Molded synthetic. Provide bearing at both duct wall penetrations.
7. Tie Bars and Brackets: Aluminum.

C. Damper Hardware:

1. Zinc-plated, die-cast quadrant with dial and handle made of zinc plated steel, and a hexagon lock nut. Friction lock dampers are not acceptable where system external static pressure exceeds 0.50"wc.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform or stand-off for insulated duct mounting.

2.4 CURTAIN TYPE FIRE DAMPERS (1½ HOUR)

A. Manufacturers:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. PCI Industries - Pottorff
5. Prefco; Perfect Air Control, Inc.
6. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 by a NRTL.

C. Pressure: Dampers shall have a minimum UL 555 differential pressure rating of 4 in. WG

D. Velocity: Dampers shall have a minimum UL 555 velocity rating of 2000 FPM.

E. Fire Rating: 1½ hours.

F. Frame: Curtain type with blades outside airstream; fabricated of roll-formed galvanized steel; with mitered and interlocking corners.

G. Sleeve: Factory-installed, galvanized sheet steel.

1. Minimum Thickness: Per UL requirements.
2. Minimum Length: To suit application.

H. Mounting Orientation: Vertical or horizontal.

I. Blades: Roll-formed, interlocking galvanized sheet steel. In place of interlocking blades, full-length galvanized-steel blade connectors may be used.

J. Horizontal Dampers: Include stainless-steel closure spring.

K. Fusible Link: Replaceable, 165 deg F rated.

L. Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing

2.5 MULTI BLADE FIRE DAMPERS (1½ HOURS)

A. Manufacturers:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. PCI Industries - Pottorff
5. Prefco; Perfect Air Control, Inc.
6. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Pressure: Dampers shall have a minimum UL 555 differential pressure rating of 4 in. WG

D. Velocity: Dampers shall have a minimum UL 555 velocity rating of 4000 FPM.

E. Fire Rating: 1½ hours.

F. Frame: Multiple-blade type; fabricated of galvanized steel; with mitered and interlocking corners.

G. Sleeve: Factory-installed, galvanized sheet steel.

1. Minimum Thickness: Per UL requirements.
2. Minimum Length: To suit application.

H. Mounting Orientation: Vertical or horizontal.

I. Blades: Blades: Damper blades shall be galvanized steel. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction. Provide symmetrical blades of varying size as required to completely fill the damper opening.

J. Blade Stops: Locate blade stops at top and bottom of damper frame. They shall occupy no more than ½" of the damper opening area.

K. Bearings: Axle bearings shall be sintered bronze.

L. Horizontal Dampers: Include stainless-steel closure spring.

M. Fusible Link: Replaceable, 165 deg F rated.

N. Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing.

2.6 SMOKE DAMPERS

A. Manufacturers:

1. Johnson Controls
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation. (Basis of design, provide model SMD-301)

4. Nailor Industries, Inc.
5. PCI Industries - Pottorff
6. Ruskin Company.

B. General Requirements: Rated and labeled according to UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch WC static pressure class and minimum 3000 FPM velocity.

D. Smoke Detector: Provide factory-mounted and -wired smoke detector with smoke damper or provide field-mounted smoke detector installed within five feet of damper. Detector shall be a listed and labeled. Provide normally open contacts for monitoring by the fire alarm system.

1. Minimum Velocity: Zero feet per minute.
2. Maximum Velocity: Three thousand feet per minute minimum.

E. Configuration: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Blades: Roll-formed, horizontal, interlocking, 0.07 inch thick, galvanized sheet steel air foil.

G. Blade edge seals: Silicone rubber.

H. Blade linkage: Out of air stream.

I. Leakage: Class II.

J. Mounting Sleeve: Factory-installed galvanized sheet steel; length to suit wall or floor application.

K. Damper Motor: Two-position.

L. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size shall be large enough so driven load will not require motor to operate in service factor.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section "Building Automation System" and Division 28 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 IN x LBF and breakaway torque rating of 150 IN x LBF.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at 0 degrees F.

M. Accessories:

1. Auxiliary switches for position indication.
2. Damper mounted momentary test switch.

2.7 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:

1. Johnson Controls
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation. (Basis of design, provide model FSD-331)
4. Nailor Industries, Inc.
5. PCI Industries - Pottorff
6. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by a NRTL.

C. Closing rating in ducts up to 4-inch WC static pressure class and minimum 2000 FPM velocity.

D. Fire Rating: 3 hours or as indicated.

E. Smoke Detector: Provide factory-mounted and -wired smoke detector with smoke damper or provide field-mounted smoke detector installed within five feet of damper. Detector shall be a listed and labeled. Provide normally open contacts for monitoring by the fire alarm system.

1. Minimum Velocity: Zero feet per minute.
2. Maximum Velocity: Three thousand feet per minute minimum.

F. Configuration: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

G. Heat-Responsive Device: Electric resettable link and switch package, factory installed and rated. Provide damper position indicator to indicate open & closed positions.

H. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

I. Bearings: Sintered bronze.

J. Blades: Roll-formed, horizontal, interlocking, 0.07 inch thick, galvanized sheet steel air foil.

K. Blade edge seals: Silicone rubber.

L. Blade linkage: Out of air stream.

M. Leakage: Class II.

N. Mounting Sleeve: Factory installed galvanized sheet steel; length to suit wall or floor.

O. Damper Motors: Two-position.

P. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size shall be large enough so driven load will not require motor to operate in service factor.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section "Building Automation System" and Division 28 Sections.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 IN x LBF and breakaway torque rating of 150 IN x LBF.
4. Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Provide motors with internal heaters to permit normal operation at 0 degrees F.

Q. Accessories:

1. Auxiliary switches for position indication.
2. Damper mounted momentary test switch.

2.8 CEILING RADIATION DAMPERS

A. Manufacturers:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation. (Basis of design, provide model CRD-1)
4. McGill AirFlow LLC.
5. METALAIRE, Inc.
6. PCI Industries - Pottorff
7. Prefco; Perfect Air Control, Inc.
8. Ruskin Company.

B. General Requirements:

1. Labeled according to UL 555C by an NRTL.
2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

F. Fire Rating: 3 hours.

2.9 FLANGE CONNECTORS

A. Available Manufacturers:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Match connecting ductwork.

D. Gauge: 18, 20, or 24 as recommended by manufacturer or match connecting ductwork.

2.10 MANUFACTURED TURNING VANES

A. Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

C. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.11 REMOTE DAMPER OPERATORS

A. Manufacturers:

1. Metropolitan Air Technology.
2. PCI Industries – Pottorff.
3. Ruskin Company.
4. Ventfabrics, Inc.
5. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Operator Mounting Location: As indicated. If not indicated;

1. In airstream terminating at face of diffuser.
2. Outside airstream terminating at round ceiling cup.
3. If multiple diffusers are affected, then in nearest diffuser.

2.12 DUCT-MOUNTED ACCESS DOORS

A. Available Manufacturers:

1. Ductmate Industries, Inc.
2. Flexmaster U.S.A., Inc.
3. Greenheck Fan Corporation.
4. Keys
5. McGill AirFlow LLC.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.13 FLEXIBLE CONNECTORS

A. Do not use on smoke control/management fans. Install on all other fans and fan equipped units even when provided with internal isolation.

B. Available Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Hart & Cooley, Inc.

C. Materials: Flame-retardant or noncombustible fabrics.

D. Coatings and Adhesives: Comply with UL 181, Class 1.

E. Connector: Factory fabricated with a fabric strip 3½ to 4½ inches wide attached to 2 strips of 2½ to 4½ inches wide, 23 to 25 gauge "0.0269 to .0209 inch thick" galvanized sheet steel, stainless sheet steel, or aluminum sheets. Provide metal compatible with connected ducts.

F. Fabric: Glass fabric coated with silicone rubber complying with NFPA 90A and NFPA 90B.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

G. Thrust Limiters:

1. Field fabricated cable restraints on equipment producing greater than 4.0" WC of positive pressure.
2. Field fabricated cable restraints as detailed. If not detailed; Provide restraint consisting of a 1/16 inch diameter vinyl coated steel cable at 24" maximum on center, attached to flange bolts on each side of flexible connector. Cable length shall be such that, when in tension, ½" of movement in the flexible connection is preserved. If flanges are not used, contractor may provide steel, stainless steel, or aluminum angles for attaching cables. Match duct material. Cables shall attach to screw or fastener holding angle to duct and shall be routed through a 3/16" diameter hole in the bracket offset approximately 1" from duct.
3. Direction of connector movement: Parallel with airflow, perpendicular to connector.

2.14 FLEXIBLE AIR DUCTS

A. Manufacturers:

1. Flexmaster U.S.A., Inc. (Basis of design, Provide Type 8M)
2. Thermaflex
3. Hart & Cooley, Inc.

B. Provide bead on connecting duct for sizes greater than 12" in diameter.

C. Insulated, Flexible Duct: UL 181, Class 1 or 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch WC positive and 1.0-inch WC negative.
2. Maximum Air Velocity: 5000 fpm.
3. Vapor Barrier Permeance: 0.05 perm

4. Temperature Range: Minus 10 to plus 160 deg F.
5. Insulation R-value: 6.0

D. Flexible Duct Connection Accessories:

1. Low pressure (Not up stream of terminal units):
   a. Clamps: Nylon strap in sizes 3 through 20", to suit duct size.
   b. Sheet metal screws: No
   c. Liquid adhesive: No
   d. Tape: Yes
2. Medium pressure (Up stream of terminal units):
   a. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with worm-gear action in sizes 3 through 20 inches, to suit duct size.
   b. Sheet metal screws: No
   c. Liquid adhesive: Yes
   d. Tape: Yes

2.15 ACCESSORY HARDWARE

A. Temporary Test Holes: Drilled in duct as required.

B. Permanent Test Holes: Cast iron, or cast aluminum, to suit adjacent material, including cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit wall + insulation thickness.

C. Adhesives: High strength, quick setting, waterproof, and resistant to grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install permanent test holes at fan inlets and outlets.

F. Install permanent test holes where indicated.

G. Provide temporary test holes where necessary for testing.

H. Install temporary test hole plugs in temporary test holes.

I. Repair insulation at temporary test holes.

J. Install fire dampers according to UL listing.

K. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. At outdoor-air intakes and mixed-air plenums.
2. Downstream of control dampers, and equipment.
3. Adjacent to and close enough to fire or smoke dampers, to reset and reinstall fusible links.
4. Upstream or downstream of elbows with turning vanes for inspection and cleaning.
5. At control devices requiring inspection.
6. Elsewhere as indicated.

L. Install access doors with swing against duct static pressure except at fire dampers.

M. Access Door Size: Largest of the following permitted by duct dimensions:

1. 8 by 5 inches.
2. 12 by 6 inches.
3. 18 by 10 inches.
4. 21 by 14 inches.
5. 24 by 24 inches.

N. Label access doors to indicate purpose.

O. Install flexible connectors to connect ducts to air moving equipment.

1. Exception: Smoke control/management equipment.

P. Connect terminal units to supply ducts with 36" of rigid duct and maximum 30" lengths of flexible duct.

Q. Connect flexible ducts to metal ducts as follows:

1. Low pressure (Not up stream of terminal units):
   a. Clamps: Install in accordance with manufacturer's recommendations.
   b. Sheet metal screws: Not required.
   c. Liquid adhesive: Not required.
   d. Tape: Install in accordance with manufacturer's recommendations.
2. Medium pressure (Up stream of terminal units):
   a. Clamps: Install in accordance with manufacturer's recommendations.
   b. Sheet metal screws: Not required.
   c. Liquid adhesive: Yes
   d. Tape: Yes

R. Connect flexible ducts to diffusers using a radius forming brace or rigid elbow. If using radius forming brace, deduct four (4) duct diameters from the indicated maximum flexible duct length.

S. Install temporary test holes where required for testing and balancing purposes. Cap with neoprene, plastic or rubber plugs and repair insulation with like material.

T. Install permanent test holes upstream and downstream of each fan within 6" of fan. Install in unit wall or adjacent duct.

1. Exception: Outlet of roof mounted fans

U. Install thrust limiters at all flexible connectors consisting of a 1/16 inch diameter vinyl coated steel cable at 24" maximum on center, attached to flange bolts on each side of flexible connector. Cable length shall be such that, when in tension, ½" of movement in the flexible connection is preserved. If flanges are not used, contractor may provide steel, stainless steel, or aluminum angles for attaching cables. Match duct material. Cables shall attach to screw or fastener holding angle and shall be routed through a 3/16" diameter hole in the angle offset approximately 1" from duct.

V. TURNING VANES:

1. Install turning vanes in all duct elbows larger than 12" in height or width.
2. Exceptions:
   a. Where prohibited by the applicable code.
   b. Where prohibited by laws or ordinances.
   c. Where prohibited by local requirements.
   d. Where specifically eliminated by contract.

W. FIELD QUALITY CONTROL

1. Tests and Inspections:
   a. Operate dampers to verify full range of movement without interference.
   b. Inspect access doors. Verify that door can be opened and closed. Verify fire damper, and combination fire and smoke damper fusible links can be reset and changed. Verify fire damper, and combination fire and smoke damper doors open in the direction of air pressure (out on supply ducts and in on return and exhaust ducts).
   c. Operate fire dampers to verify full range of movement, verify non-interference, and verify that the proper heat-response device is installed.
   d. Inspect elbows for turning vanes. Verify they are installed where required.
   e. Inspect turning vanes using access doors for proper and secure installation.
   f. Operate remote damper operators prior to ceiling installation to verify full range of movement of operator and damper. Verify no interference with damper movement.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

A. Operating Limits: Classify according to AMCA 99.

B. Curb shims:
1. Permitted: On one edge only and then only for edge lengths equal to or less than 48".
2. Continuous: From one corner to the other.
3. Structural Support: Continuous along entire length of shim.
4. Material: Steel.
5. Minimum Thickness: 1/16".
6. Maximum Overall Thickness: 1".

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs with required slope and dimensions. Indicate shimming if required.
7. Security fasteners.
8. Fan speed controllers.

B. Product Data: Include manufacturer's technical data for each ventilator, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, accessories, and mounting requirements.

C. Shop Drawings:
1. Detail equipment assemblies, include:
   a. Internal components
   b. Dimensions
   c. Weights
   d. Loads
   e. Supports
   f. Required clearances.

2. Provide method of field assembly.
3. Indicate:
   a. Components
   b. Location
   c. size of each field connection
4. Provide Wiring Diagrams for:
   a. Power
   b. Signal
   c. Control
5. For ventilator support comply with performance requirements and design criteria, including analysis data signed and sealed by a qualified professional engineer responsible for selection.
   a. Calculations: Calculate requirements for selecting vibration isolation, seismic restraint where required**,** and for vibration isolation.
   b. Detail mounting, securing, dimensions, slope, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system. Indicate shimming if required.
   c. Restraint: Detail fabrication and attachment of restraints. Indicate anchorage details, quantity, diameter, and connections..

D. Operation and Maintenance Data: For ventilators to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

F. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.4 TOOLS

A. Four (4) complete tools (all hardware) required to remove and reinstall security fasteners.

B. Specifications, including size, of tool required to remove and reinstall security fasteners.

C. The name and address of three local tool suppliers where tools may be obtained.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for grease (kitchen) hood exhaust shall also comply with UL 762.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven fan. Mark belt set with fan ID and turn over to owner's representative.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATOR(S) (DOWNBLAST)

A. Manufacturers:
1. Acme Engineering & Manufacturing Corporation.
2. Twin City Fan & Blower.
3. Greenheck Fan Corporation.
4. Loren Cook Company.

B. Housing: Removable, spun-aluminum dome top and outlet baffle, or extruded-aluminum, rectangular top to direct discharge air downward.

C. Base (Curb Cap): Square, one-piece, aluminum with venturi inlet cone.

D. Fan Wheels: Statically and dynamically balanced aluminum hub and wheel with backward-inclined blades matched to inlet cone.

E. Belt Drives: Comply with the following:

1. Provide drives sized for a minimum of 150% of driven horsepower.
2. Provide resilient mounting to housing.
3. Belt(s):
   a. Provide grip notch belt(s).
   b. Provide belt tensioner.
4. Provide cast iron, adjustable pitch pulleys keyed to shaft.
5. Provide motor isolated from ducted airstream.
6. Shaft Bearings:
   a. Provide permanently lubricated pillow block type.
   b. Provide sealed bearings.
   c. Provide self-aligning type.
   d. Provide ball bearings selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speed.

7. Fan Shaft:
   a. Provide turned shaft.
   b. Provide ground shaft.
   c. Provide polished steel shaft.
   d. Key shaft to fan wheel.

F. Fan/Motor Shaft:
1. Provide motor manufacturer's standard shaft.
2. Key shaft to fan wheel.

G. Motors and drives:
1. Mount on vibration isolators.
2. Draw air for motor cooling into the motor compartment from an area free of discharge contaminants.
3. Make readily accessible for maintenance.

H. Overload (Running) Protection:
1. Provide motor overload protection as a requirement of this section.
2. Provide motor overload protection as recommended by the manufacturer
3. Comply with the Section 230513 "Motors for HVAC Equipment"

I. Wind-band: Join to curb-cap with leak-proof continuously welded seam.

J. Accessories:
1. Provide disconnect switch.
2. Provide removable, 1/2-inch mesh, aluminum or brass wire bird screen.
3. Provide parallel-blade dampers mounted in fan base or duct with normally closed electric actuator wired to close when fan stops. Actuator shall not be required to fail closed.

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers:

1. Acme Engineering & Manufacturing Corporation.
2. Greenheck Fan Corporation.
3. Loren Cook Company.
4. Twin City Fan & Blower.

B. Housing: Manufacturer's standard steel, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

D. Belt-Driven Units: Motor mounted on adjustable base, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Provide accessories:

1. Variable-Speed Controller: None. Provide manual damper on inlet for initial (rough) balancing.

2. Companion Flanges: For inlet and outlet duct connections.
3. Motorized Dampers: Parallel-blade dampers mounted in duct with electric actuator; wired to close when fan stops. When fan voltage exceeds 220 V provide 50VA minimum transformer to operate damper.

2.3 MOTORS

A. Refer to section "Common Motor Requirements for HVAC Equipment."

B. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.

1. Motor Sizes: Size shall be as indicated. If not indicated, provide motor large enough to drive load and avoid operation in service factor range above 1.0.
2. Controls: Provide controllers, electrical devices, and wiring to comply with requirements specified in Division 26 Sections.

C. Enclosure Type: Totally enclosed, fan cooled.

2.4 FASTENERS

A. Security: Button head 1/4" diameter by 1-1/4" long (minimum size) sheet metal screws with torx head and center reject pin.

B. Refer to paragraph "SUBMITTALS"

2.5 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

2.6 ROOF CURB:

A. Refer to drawings and Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Provide under this section.

C. Height: 12" greater than adjacent roof insulation.

D. Slope: Match structure. Top of curb shall be level and each edge shall be flush with other edges on all sides.

E. Minimum Height Measured From top of roof insulation: 12"

F. Sloped Mounting: Provide curb manufactured for roof slope to maintain fan level where installed on a sloped structure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install HVAC Power Ventilators level and plumb.

B. Secure roof-mounted fans to roof curbs with security fasteners. Refer to Section "Roof Accessories" for other installation requirements for roof curbs.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 0.5 inches.

E. Install units with clearances for service and maintenance.

F. Label units.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that Shipping blocking and bracing are removed.

2. Verify that unit is secure and connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. For belt drive units disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align belts, adjust belt tension, and install belt guards.
5. Adjust damper linkages & operators for proper damper operation.
6. Verify lubrication for bearings and other moving parts.
7. Verify that manual and automatic volume control, fire, smoke, and fire/smoke dampers in connected ductwork systems are in a fully open position.
8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm.
9. Measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.3 TESTING, ADJUSTING, BALANCING, AND LUBRICATION

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC".

C. Replace fan and motor pulleys to achieve design airflow.
1. Disable automatic temperature-control operators, energize motor and adjust fan to required rpm.
2. Measure and record RPM.
3. Measure and record motor voltage and amperage.

D. Re-lubricate bearings.

END OF SECTION 233423

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

1. Seismic Hazard Level A: Force to weight ratio = 0.48.
2. Seismic Hazard Level B: Force to weight ratio = 0.30.
3. Seismic Hazard Level C: Force to weight ratio = 0.15.

1.3 ABBREVIATIONS

A. ° Degree, Degrees.

B. BAS Building Automation System.

C. CFM Cubic Feet per Minute.

D. ECM Electronically Commutated Motor.

E. F Fahrenheit.

F. PSIG Pounds per Square Inch Gauge.

G. PSC Permanent Split Capacitor

H. SCR Silicon Controlled Rectifier.

I. VA Volt Amps. (A measure of transformer power)

1.4 SUBMITTALS

A. Pre-submittal Meeting: A representative of the manufacturer producing equipment being provided under this section of the specifications shall attend a meeting for the purpose of coordinating with the contractor performing work under section "Building Automation System". The meeting shall be held at a location of the Contractor's choosing. The Contractor

shall arrange the meeting. Submittals shall be essentially complete at the time of the meeting so detailed coordination items can be discussed.

B. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.

1. Air terminal units.
2. Liners and adhesives.
3. Sealants and gaskets.
4. Seismic restraint devices.

C. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Hangers and supports, including methods for duct and building attachment, bracing, and vibration isolation.

D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 - PRODUCTS

2.1 PARALLEL FAN POWERED AIR TERMINAL UNITS

A. Manufacturers:

1. Anemostat Products; a Mestek Company.
2. METALAIRE, Inc.
3. Price Industries.

4. Titus.
5. Trane; a business of American Standard Companies.

B. Configuration: Volume-damper assembly and fan in parallel arrangement inside unit casing with control components inside a protective metal shroud.

C. Casing: Single wall.

1. Casing Lining: Perforated galvanized steel with Adhesive attached, 1" thick polyurethane foam or fiber free insulation complying with UL 181 erosion requirements, and having a maximum flame spread index of 25 and a maximum smoke developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Motorized Volume Damper: Galvanized steel with flow sensing element, peripheral gasket, and bearings. Operating range shall be 90 degrees.

E. Velocity Sensors: Multipoint array with velocity sensors in inlet duct connection.

F. Motor: Refer to Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Type: PSC.
2. Design: Designed for speed control. Use with a SCR or other technology for fan speed adjustment. Provide means of speed control on the terminal unit by the terminal unit manufacturer.

G. FAN

1. Type: Forward curved centrifugal.
2. Isolation: Rubber in shear.
3. Speed Control: Infinitely adjustable.
4. Provide Backdraft Damper.

H. Filters: Where return is not ducted to unit, provide 1" thick, pleated filter, MERV 8, in filter rack at terminal unit inlet.

I. Hydronic Heating Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1", tested at 300 PSIG and rated for a minimum working pressure of 200 PSIG at a maximum entering-water temperature of 220° F. Include manual air vent and drain valve.

J. Factory mounted and wired components:

1. Electrical components and BAS unit controller mounted in control box with removable cover. Incorporate single point electrical connection to power source.
2. Control Transformer: 50 VA minimum factory mounted transformer for control voltage. Input voltage shall match the circuit provided. Coordinate output voltage with contractor performing work under Section "Building Automation System". Provide terminal strip in control box and field wiring of BAS unit controller to terminal strip. Wiring shall be as indicated.
3. Wiring Terminations: Fan, heat, and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors and BAS requirements. Enclose terminal lugs in terminal box sized according to NFPA 70.
4. Disconnect Switch: Factory mounted fused.

K. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit to enclose controller furnished under Section "Building Automation System".

L. Electronic Controls: Provide bidirectional damper, integral airflow measurement device, and transducer. Control devices shall be compatible with temperature controls specified in Section "Building Automation System" and shall comply with the following:

1. Install microprocessor based controller furnished under Section "Building Automation System"
2. Install damper actuator provided under this section.
3. Provide airflow transducer. Output shall be compatible with controller.

M. Control Sequence:

1. As indicated in Section "Sequences of Control"

2.2 SERIES FAN POWERED AIR TERMINAL UNITS

A. Manufacturers:

1. Anemostat Products.
2. MetalAire, Inc.
3. Nailor Industries, Inc.
4. Price Industries.
5. Titus.
6. Trane.

B. Configuration: Volume-damper assembly and fan in series arrangement inside unit casing with control components inside a protective metal shroud for installation above a ceiling.

C. Casing: Single wall.

1. Casing Lining: Adhesive attached, 1" thick fiberglass insulation complying with UL 181 erosion requirements, and having a maximum flame spread index of 25 and a maximum smoke developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Motorized Volume Damper: Galvanized steel with flow sensing element, peripheral gasket, and bearings. Operating range shall be 90 degrees.

E. Velocity Sensors: Multipoint array with velocity sensors in inlet duct connection.

F. Motor: Refer to Division 23 Section "Common Motor Requirements for HVAC Equipment."
1. Type: ECM.
2. Design: Designed for speed control. Use with a SCR or other technology for fan speed adjustment. Provide means of speed control on the terminal unit by the terminal unit manufacturer.

G. Fan:
1. Type: Forward curved centrifugal.
2. Isolation: Rubber in shear.
3. Speed Control: Infinitely adjustable.

H. Filters: Where return is not ducted to unit, provide 1" thick, pleated filter, MERV 8, in filter rack at terminal unit inlet.

I. Hydronic Heating Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1", tested at 300 PSIG and rated for a minimum working pressure of 200 PSIG at a maximum entering-water temperature of 220° F. Include manual air vent and drain valve.

J. Factory mounted and wired components:
1. Electrical components and BAS unit controller mounted in control box with removable cover. Incorporate single point electrical connection to power source.
2. Control Transformer: 50 VA minimum factory mounted transformer for control voltage. Input voltage shall match the circuit provided. Coordinate output voltage with contractor performing work under Section "Building Automation System". Provide terminal strip in control box and field wiring of BAS unit controller to terminal strip. Wiring shall be as indicated.
3. Wiring Terminations: Fan, heat, and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors and BAS requirements. Enclose terminal lugs in terminal box sized according to NFPA 70.
4. Disconnect Switch: Factory mounted fused.

K. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit to enclose controller furnished under Section "Building Automation System".

L. Electronic Controls: Provide bidirectional damper, integral airflow measurement device, and transducer. Control devices shall be compatible with temperature controls specified in Section "Building Automation System" and shall comply with the following:

1. Install microprocessor based controller furnished under Section "Building Automation System"
2. Install damper actuator provided under this section.
3. Provide airflow transducer. Output shall be compatible with controller.

M. Control Sequence:

1. As indicated in Section "Sequences of Control."

2.3 SINGLE DUCT AIR TERMINAL UNITS

A. Manufacturers:

1. Anemostat Products; a Mestek Company.
2. METALAIRE, Inc.
3. Price Industries.
4. Titus.
5. Trane; a business of American Standard Companies.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

Casing: Single wall galvanized sheet steel.

1. Sheet Metal Thickness: Manufacturer's standard.
2. Casing Lining: Manufacturer's standard 1" thick fiber free, having a maximum flame spread index of 25 and a maximum smoke developed index of 50. Insulation shall comply with UL 181 erosion requirements.
3. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment. Provide flexible connector.
4. Air Outlet: S-slip and drive connections. Provide flexible connector.
5. Access: Removable panels with airtight gaskets for access to parts requiring service, adjustment, or maintenance.
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Damper Position: Normally open.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. When indicated provide a Hydronic Heating Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1", tested at 300 PSIG and rated for a minimum working pressure of 200 PSIG at a maximum entering-water temperature of 220° F. Include manual air vent and drain valve.

E. Factory mounted and wired components:

1. Electrical components mounted in control box with removable cover. Incorporate single point electrical connection to power source.
2. Control Transformer: 50 VA minimum factory mounted transformer for control voltage. Input voltage shall match the circuit provided. Coordinate output voltage with contractor performing work under Section "Building Automation System". Provide terminal strip in control box and field wiring of BAS unit controller to terminal strip. Wiring shall be as indicated.
3. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors and BAS requirements. Enclose terminal lugs in terminal box sized according to NFPA 70.
4. Disconnect Switch: Factory mounted fused.

F. Control Sequence:

1. As indicated in Section "Sequences of Control"

2.4 HANGERS AND SUPPORTS

A. Hanger Rods: Cadmium-plated steel rods and nuts.

B. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

C. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.5 SOURCE QUALITY CONTROL

A. Label each air terminal unit with tag, nominal airflow, maximum and minimum factory-set airflows, coil type if coil is included, and ARI certification seal.

B. For hydronic coils include hose kit and control valve shrink wrapped and labeled with terminal unit tag.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder actuated concrete fasteners for standard-weight aggregate concretes and for slabs equal to or more than 4" thick.
4. Do not use powder actuated concrete fasteners for lightweight aggregate concretes and for slabs less than 4" thick.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

A. Install piping adjacent to air terminal unit to allow service and maintenance.

B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Connect ducts to air terminal units according to division 23 duct specification sections for metal and flexible ducts.

D. Make connections to air terminal units with flexible connectors complying with requirements in Division 23 Section "Air Duct Accessories."

3.4 IDENTIFICATION

A. Label each air terminal unit with tag, nominal airflow, and maximum and minimum factory set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs/labels.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Air terminal unit will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, mounting details, and performance data including throw, drop, static pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Installation Drawings: Drawn to scale (Minimum 1½" = 1'-0"), on which the following items are indicated:

1. Trim & borders.
2. Ceiling suspension assembly members.
3. Method of attaching hangers to building structure.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES, AND REGISTERS

A. Manufacturers:

1. Anemostat; a Mestek Company.
2. Carnes.
3. Krueger.
4. METALAIRE, Inc.; Metal Industries Inc.
5. Nailor Industries
6. Price Industries.
7. Titus.
8. Tuttle & Bailey.

B. General:

1. The basis of design for each grille register and diffuser is indicated on the drawings. The contractor shall provide equivalent products by one of the listed manufacturers.

2. Where aluminum construction is indicated blades and frames shall be extruded.
3. All trim pieces shall be mechanically fastened. Friction fit trim rings/frames shall not be provided or shall be mechanically fastened in the field. Fasteners shall not be visible.
4. Units located on walls in heavy use areas including but not limited to basketball courts, gymnasiums, and shop areas shall be heavy duty steel. If not scheduled as heavy duty steel notify architect.
5. Finish: Powder Coated or Baked enamel, white.
6. Filter Grille Mounting Frame: Shall accept a 2" deep MERV 8 (30%) pleated media filter. Refer to section "Filters" for filter requirements. Provide two sets of filters for each filter grille.
7. Mounting: As Scheduled.
8. Damper Type: Adjustable opposed-blade assembly where damper is indicated on the schedule.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Install diffusers, registers, and grilles flush with ceiling unless otherwise indicated in contract documents.

C. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Install in locations indicated, as much as practical. For units installed in lay-in ceiling panels, center units in both directions in panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

D. Diffusers, registers and grilles shall be supported independently of the ceiling system and shall not be supported from conduit, piping or unrelated ductwork.

E. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 234100 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. VUSBC: Virginia uniform statewide building code.

G. HEPA: High-efficiency particulate air.

H. Construction Filter: A filter maintained during construction to protect ductwork from construction dust, dirt, and debris. Construction filters shall be removed temporarily during balancing and permanently after the building is occupied.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated include dimensions, required operating clearances, required access clearances, and weights.

B. Operating Characteristics: For each type of product indicated provide rated flow capacity, initial and final pressure drop at rated flow capacity.

C. Efficiency: For each type of product indicated provide efficiency and test method.

D. Fire Classification: For each type of product indicated provide the fire classification.

E. Specialties and Accessories: For each type of product indicated provide furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

B. Replace all permanent filters with new filters of types specified.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
2. Comply with ASHRAE 52.1 for arrestance and ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.

C. Comply with NFPA 90A and NFPA 90B.

1.6 COORDINATION

A. Coordinate sizes and locations:
1. Within air handling units.
2. On open return ducts during construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Air Filters, and Filter-Holding Systems:

a. AAF International.
b. Airguard Industries, Inc.
c. Barnebey & Sutcliffe Corp.
d. Columbus Industries, Inc.
e. Continental Air Filter Div.; NiCon Filter Corp.
f. Farr Co.
g. Flanders Filters, Inc.

h. International Air Filter, Inc.
i. Koch Filter Corp.
j. Research Products Corp.

2. Filter Gages:

a. Airguard Industries, Inc.
b. Dwyer Instruments Inc.

2.2 GENERAL FILTERS

A. For return filter grilles, general filtration, and construction filters provide the following:
1. Media: Cotton and synthetic pleated with an average efficiency of 25-30% and an average arrestance of 90-92% in accordance with ASHRAE test standard 52.1-1992.
2. Thickness: Unless otherwise indicated thickness shall be 2".
3. Media Support Grid: Welded wire on 1" centers with 96% free area bonded to the media.
4. Filter Frame: High wet strength cardboard with diagonal support members bonded to the media on the entering side and exiting side of each pleat.
5. Holding Frame: Galvanized steel with metal grid on outlet side, polyurethane gaskets, and spring fasteners.
6. Farr 30/30 or equal.

2.3 PRE-FILTERS (MERV-8)

A. Where pre-filters are indicated and for construction filters provide the following:
1. Media: Cotton and synthetic pleated with an average efficiency of 25-30% and an average arrestance of 90-92% in accordance with ASHRAE test standard 52.1-1992.
2. Thickness: Unless otherwise indicated thickness shall be 4".
3. Media Support Grid: Welded wire on 1" centers with 96% free area bonded to the media.
4. Filter Frame: High wet strength cardboard with diagonal support members bonded to the media on the entering side and exiting side of each pleat.
5. Holding Frame: Galvanized steel with metal grid on outlet side, polyurethane gaskets, and spring fasteners.
6. Farr 30/30 or equal.

2.4 FINAL FILTERS (CARTRIDGE TYPE) (MERV-13)

A. Where cartridge type final filters are indicated on the drawings provide the following:
1. Media: High density microfine glass fibers, laminated to a reinforcing backing to form a lofted filter blanket.
2. Efficiency: Filter media shall have an average efficiency of 80-85% and an average arrestance of 98% in accordance with ASHRAE test standard 52.1-1992. Minimum MERV 13.
3. Thickness: Unless otherwise indicated thickness shall be 12".
4. Media Support Grid: Welded wire on 1" centers with 96% free area bonded to the media.
5. Contour Stabilizers: Aluminized zinc finished steel strips permanently installed on the entering and leaving side of the filter. Filter shall withstand 10" of static pressure drop without noticeable distortion.

6. Filter Frame: Aluminized zinc finished steel with filter pack mechanically and chemically bonded to eliminate air bypass. Provide aluminized zinc finished steel diagonal supports
7. Holding Frame: 16 Gauge galvanized steel with polyurethane gaskets, and positive sealing fasteners.
8. Farr Riga-Flo 100 or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Position each filter with clearance for normal service and maintenance.

B. Install filters to prevent passage of unfiltered air.

C. Do not operate fan system until filters are in place. During construction all ductwork must be protected from dirt and debris. Remove filters used during construction and testing. Replace all filters in units with new filters of types specified.

D. Unit operation during construction:
1. Install construction filters to protect all return ductwork from dirt and debris. Supply fan shall operate at all times.

E. Unit not operating during construction:
1. Install plastic sheet material over all supply and return openings to protect all ductwork from dirt and debris.
2. Fans shall be off.

F. Construction filter installation: Adhere all edges of filter with metal foil peel-n-stick tape having an acrylic adhesive.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.
1. Check for leakage of unfiltered air while system is operating.

B. Air filter and installation will be considered defective if they do not pass.

C. Prepare a report for each filter.

3.3 CLEANING

A. After completing system installation and testing, adjusting, and balancing of air distribution systems, clean unit filter housings and install new filters.

END OF SECTION 234100

SECTION 235100 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Type B and BW vents.
   2. Special gas vents.

B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and seismic restraints, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that factory-fabricated breeching, chimneys, and stacks; accessories; and components will withstand indicated seismic forces. Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Breeching, Chimneys, and Stacks: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of anchorage devices on which the certification is based and their installation requirements.

B. Manufacturer's Certification: Manufacturer's certified vent system sizing calculations.

C. Warranty: Warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain listed system components through one source from a single manufacturer.
   1. Exception(s): Vent kit(s) provided with boiler(s).

B. Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.

C. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

1.5 COORDINATION

A. Coordinate installation of wall and roof penetrations.

B. Coordinate installation of supports.

1.6 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, structural failures caused by expansion and contraction.

B. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 VENT KIT

A. Refer to appliance specification section.

2.2 LISTED TYPE B AND BW VENTS

A. Manufacturers:
1. Heat-Fab Inc.
2. Hart & Cooley Inc.
3. Metal-Fab, Inc.
4. Schebler Co. (The)
5. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
6. Van-Packer Co.

B. Description: Double wall metal vents tested according to UL 441 and rated for 480° F continuously for Type B, or 550° F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211 and suitable for certified gas-fired appliances.

C. Construction: Inner shell and outer jacket separated by a minimum ¼" airspace.

D. Inner Shell: One of the following;
1. ASTM B 209, Type 1100 aluminum.
2. ASTM B 209, Type 3003 aluminum.
3. ASTM B 209, Type 3105 aluminum.
4. ASTM A 666, Type 430 stainless steel.

E. Outer Jacket: Galvanized or aluminized steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners. Fabricate from similar materials and designs as vent-pipe straight sections; all shall be listed for the same assembly.

G. Termination: One of the following;
1. Stack cap designed to exclude 90 percent of rainfall.
2. Round chimney top designed to exclude 98 percent of rainfall.
3. Exit cone with drain section incorporated into riser.

2.3 LISTED SPECIAL GAS VENT

A. Manufacturers:
1. Heat-Fab Inc.
2. Hart & Cooley Inc.
3. Metal-Fab, Inc.
4. Schebler Co. (The).
5. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
6. Van-Packer Co.

B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480° F continuously, with positive or negative flue pressure complying with NFPA 211 and suitable for condensing-gas appliances.

C. Construction: Inner shell and outer jacket separated by a minimum ½"airspace.

D. Inner Shell: ASTM A 959, Type 29-4C stainless steel.

E. Outer Jacket: Aluminized, or stainless steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners. Fabricate from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

G. Termination: One of the following;
1. Stack cap designed to exclude 90 percent of rainfall.
2. Round chimney top designed to exclude 98 percent of rainfall.
3. Exit cone with drain section incorporated into riser.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF LISTED VENTS AND CHIMNEYS

A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent. Terminate three feet zero inches above nearest adjacent roof or wall surface within a ten foot radius.

B. Seal between sections of positive pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

D. Not required for non-condensing appliances: Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.

E. Join sections with acid-resistant joint cement to provide continuous joint and smooth interior finish.

F. Erect stacks plumb to finished tolerance of no more than one inch out of plumb from top to bottom.

G. All parts exposed above the roof shall be painted to match the roof

3.3 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

B. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.

C. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 235100

SECTION 235216 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 ACTION SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other Work.
   1. Wiring Diagrams: Power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand indicated seismic forces. Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

B. Warranty: Warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. DOE Compliance:

1. Not required for boilers in excess of 300,000 BTUH
2. Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."

E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.7 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing boilers that fail in materials or workmanship within specified warranty period.

B. Warranty Period:
1. Boiler: Two years from date of Substantial Completion.
2. Pressure Vessel / Heat Exchanger: Ten years from date of Substantial Completion for corrosion, thermal stress failure, material defects or workmanship.

PART 2 - PRODUCTS

2.1 CONDENSING BOILERS

A. Basis of Design:
1. The basis of design shall be as indicated.

B. Manufacturers:
1. Aerco International
2. Fulton Boiler Works, Inc.
3. Harsco Industrial Patterson-Kelley
4. NTI Boilers
5. Lochinvar Corporation

C. Description: Factory-fabricated, -assembled, and -tested condensing boiler with heat exchanger sealed pressure-tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake; water supply, return, and condensate drain connections; and controls.

D. Fabricate base and attachment to pressure vessel with reinforcement strong enough to resist boiler movement during a seismic event when boiler base is anchored to building structure.

E. Condensing Boiler Components:

1. Heat Exchanger: Type 316L, stainless-steel primary and secondary combustion chamber.
2. Burner:
   a. Fuel:
      1) Refer to drawings.
   b. Blower:
      1) Centrifugal fan to operate only during start of each burner sequence.
   c. Motor: Refer to section "Motors"
3. Gas Train:
   a. Combination gas valve with manual shutoff and pressure regulator. Include 100 percent safety shutoff with electronic flame supervision.
4. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
5. Casing:
   a. Control Compartment Enclosure: NEMA 250, Type 1A.
   b. Finish: Factory standard protective finish.
   c. Insulation: Minimum 2" thick. Surrounding the heat exchanger.
   d. Draft Hood: Integral.
   e. Combustion-Air Connection: Inlet duct collar and sheet metal closure over burner compartment.
6. Mufflers:
   a. Required for pulse combustion.
   b. Carbon steel intake muffler and stainless steel exhaust muffler.
7. Condensate Neutralization:
   a. Non-metalic container filled with lime stone chips or other neutralizing media.
   b. Neutralization container shall act as a trap.
   c. Neutralization container shall drain through an air gap to a floor drain.
   d. Neutralization container may serve multiple boilers.

2.2 BOILER TRIM

A. Include devices sized to comply with:
   1. ANSI B31.1, "Power Piping" when boiler operating pressure exceeds 160 psig.
   2. ANSI B31.9, "Building Services Piping." when boiler operating pressure is equal to or less than 160 psig.

B. Aquastat Controllers:
   1. Operating.
   2. Firing rate.
   3. High limit.

C. Safety Relief Valve: ASME rated to limit pressure in the boiler. Pressure setting shall be as recommended by the boiler manufacturer.

D. Boiler Air Vent: Automatic.

E. Drain Valve: Minimum ¾" hose-end ball valve.

2.3 BURNER OPERATING CONTROLS

A. Description: To maintain safe operating conditions, burner safety controls shall limit the operation of the burner.
   1. High Temperature and Pressure Cutoff: Independent of the high limit controller an automatic reset shall stop the burner if operating conditions rise above maximum boiler design pressure or temperature.
   2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be automatic reset type.
   3. Alarm Bell: Factory mounted on control panel with silence switch shall sound alarm for above conditions.

2.4 BOILER OPERATING CONTROLS

A. Refer to Section "Building Automation System"

B. Control Panel: Electric, factory-fabricated, and field-installed panel to control burner firing rate to maintain input rate required by BAS/HVAC Packaged Pumping Systems.

C. Building Automation System Interface: Factory-installed hardware and software to enable building automation system to monitor and control set point and display boiler status and alarms.

2.5 ELECTRICAL POWER

A. Single-Point Field Power Connection: Factory installed other electrical devices necessary to provide a single-point field power connection to boiler.

   1. House in NEMA 250, Type 1enclosure.
   2. Wiring shall be numbered and color-coded to match wiring diagram.
   3. Install factory wiring outside of an enclosure in a metal raceway.

2.6 VENTING KITS

A. Kit:
   1. PVC venting and combustion air if appliance is rated for PVC venting. If boiler manufacture is not rated for PVC venting, provide listed special gas vent.
   2. Horizontal vent terminal as indicated, wall passage thimble as inticated, indoor plate, vent adapter, condensate trap, and sealant.

B. Combustion-Air Intake: Horizontal vent terminal as indicated with screen, inlet air coupling, and sealant.

2.7 SOURCE QUALITY CONTROL

A. Test and inspect boilers prior to shipping in accordance with the ASME Boiler and Pressure Vessel Code: Section I, for high-pressure boilers and Section IV, for low-pressure boilers.

B. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine concrete housekeeping pads, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
   1. Boiler locations indicated on Drawings are approximate. Determine exact locations before roughing in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Install boilers level on concrete housekeeping pad.

B. Concrete Bases: Anchor boilers to concrete base as recommended by boiler manufacturer.
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18" centers around full perimeter of base.
   2. Place and secure anchorage devices using setting drawings, templates, diagrams, instructions, and directions furnished with the boiler and items to be embedded.
   3.

C. Vibration Isolation: Rubber pads with a minimum static deflection of 0.25".

D. Install gas-fired boilers according to NFPA 54.

E. Assemble and install boiler trim.

F. Install electrical devices, vent kit, and other accessories furnished with boiler but not factory mounted.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service.
   1. Exception: Boilers included as part of an HVAC Packaged Pumping System.

C. Connect gas piping full size to boiler gas inlet with union, valve, and full size eight inch long dirt leg.

D. Connect hot water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

E. Install piping from safety relief valves to six inches above concrete housekeeping pad unless indicated otherwise.

F. Connect vent kit to boiler as recommended by boiler manufacturer.

G. Install piping adjacent to boiler to allow service and maintenance.

H. Ground equipment.

I. Connect wiring.

J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 STARTUP SERVICE

A. Engage a factory authorized service representative to test, inspect, and adjust boiler components and equipment installation and to perform startup service.

B. Perform installation and startup checks according to manufacturer's written instructions.

C. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

D. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

E. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Adjust initial temperature set points.

G. Set field adjustable switches and circuit breaker trip ranges as indicated.

H. Occupancy Adjustments: Within 12 months of date of Substantial Completion, and when the temperature is below forty degrees F., provide on site service. Adjust system to suit actual occupied conditions.

I. Within two weeks of Substantial Completion prepare a written report that documents testing procedures and results.

J. Within two weeks of Occupancy Adjustments prepare a written report that documents adjustments made.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain condensing boilers.

END OF SECTION 235216

SECTION 237413 - PACKAGED OUTDOOR CENTRAL STATION AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 ABBREVIATIONS

A. ABMA American Bearing Manufacturers Association. (www.abma-dc.org)

B. ANSI American National Standards Institute. (www.ansi.org)

C. BAS Building Automation System.

D. CFM Cubic Feet per Minute.

E. DDC Direct-digital controls.

F. ECM Electrically commutated motor.

G. FPM Feet Per Minute.

H. HP Heat pump

I. RTU Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central station air handling unit. This abbreviation is used regardless of whether the unit is mounted on the roof or on an equipment pad on the ground.

J. RTU's Rooftop units. As used in this Section, this abbreviation means packaged, outdoor, central station air handling units. This abbreviation is used regardless of whether the units are mounted on the roof or on equipment pads on the ground.

K. SS Stamped Steel

L. VVT Variable-air volume and temperature.

M. W Wire

N. WG Water Gauge

1.3 DEFINITIONS

A. Archival Quality: Will last a minimum of 20 years.

B. Head end: Main temperature control computer system storing data accessible to the internet for WEB accessible systems and storing data accessible to the building system backbone for non-WEB accessible systems.

C. HP Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations.

D. Modulating: Able to electrically vary and stop in any position.

E. Outdoor air: Air outside the building or taken from outdoors and not previously circulated through the building.

F. Outdoor air measurement: Reporting of the volume of outdoor air taken into the building by RTU and reported to the building operator in CFM.

G. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations.

H. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

I. Record: Maintain in writing on original paper and maintain a copy in electronic format, file type Portable Document Format (*.PDF) is acceptable. Make paper copy available for inspection upon request by Owner, Owner's representative, Architect, or Architect's representative. Email electronic copy to requested email address when request is made by the Owner, Owner's representative, Architect, or Architect's representative. Document shall be "openable" by Owner and Architect's computer.

J. Supply-Air Fan: Fan providing supply air to conditioned space.

K. Supply air: Air entering a space from air-conditioning, heating, or ventilating equipment.

L. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

M. Two-position: Able to electrically move and stop in only two positions. Usually open or closed.

1.4 PERFORMANCE REQUIREMENTS

A. Support: RTU supports shall comply with required wind and seismic performance requirements, including analysis by a qualified professional engineer.

B. Wind-Restraint Performance shall comply with SEI/ASCE 7 for wind speed and building classification category. Provide minimum 10 lb/sq. ft. multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

C. Seismic Performance: RTUs shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. Unless otherwise indicated the term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified." The unit will not be required to operate after the event.

1.5 SUBMITTALS

A. Pre-submittal Meeting: A representative of the manufacturer producing equipment being provided under this section of the specifications shall attend a meeting for the purpose of coordinating with the contractor performing work under section "Building Automation System". The meeting shall be held at a location of the Contractor's choosing. The Contractor shall arrange the meeting. Submittals shall be essentially complete at the time of the meeting so detailed coordination items can be discussed.

B. Product Data: Provide manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, accessories, and mounting requirements.

C. Exterior Color: Manufacturer's standard color shall be acceptable.

D. Shop Drawings:

1. Detail equipment assemblies, include:
   a. Internal components
   b. Dimensions
   c. Weights
   d. Loads
   e. Supports
   f. Required clearances.
2. Provide method of field assembly.
3. Indicate:
   a. Components
   b. Location
   c. size of each field connection
4. Provide Wiring Diagrams for:
   a. Power
   b. Control
5. For RTU Support comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for support selection.
   a. Calculations: Calculate requirements for selecting vibration isolation, seismic restraint where required**,** and for vibration isolation.
   b. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system, curb slope, and curb dimensions.
   c. Restraint: Detail fabrication and attachment of restraints. Indicate anchorage details, quantity, diameter, and connections.

E. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are indicated and coordinated using input from installers:

1. Plan areas containing an RTU indicated at ¼" = 1'- 0" or greater on construction drawings.
2. Areas within 20 feet of section marks indicated on M2 series drawings where such section marks penetrate an RTU.
3. Structural members to which RTUs will be attached.
4. Related roof openings.
5. Related roof curbs, slope, dimensions and flashing.

F. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," Provide the following:

1. After successful completion of testing & balancing, or commissioning provide the following:
   a. Completed Inspection & Testing form.
   b. Record copy of site-specific software on DVD.
   c. Maintenance, Inspection and Testing Records including, may not be limited to, the following:
      1) How to test installed components.
      2) Frequency of testing of installed components.
      3) Frequency of inspection of installed components.
      4) Manufacturer's user training manuals.
2. Manufacturer's required maintenance related to system warranty requirements.
3. Software and Firmware Operational Documentation:
   a. Software operating and upgrade manuals.
   b. Program Software Backup: On magnetic media or compact disk, complete with data files.
   c. Device address list.
   d. Printout of software application and graphic screens.

G. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. System safety. Comply with one of the following:

1. ASHRAE 15 for refrigeration system safety.
2. ASHRAE/IESNA 90.1-2004 applicable requirements in Section 6 - "Heating, Ventilating, and Air-Conditioning."
3. NFPA 90A and NFPA 90B.
4. UL 1995.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Unit shall be ETL/CETL listed.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to provide labor and materials to remove and replace components of RTU's that fail in materials or workmanship within the following warranty period.

1. Compressors: 5 years from date of Substantial Completion.
2. VFD: 3 years from date of Substantial Completion.
3. Remainder of unit: 3 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Daikin-McQuay

B. Trane

C. YORK International Corporation.

2.2 GENERAL

A. Packaged VAV Rooftop Unit (Packaged VAV Rooftop Unit Serving Terminal Units Diagram): Provide a Packaged RTU, designed for VAV airflow, variable speed compressors, direct drive plenum supply fan(s), double wall casing, with electric preheat coil, outdoor air and return air dampers, economizer, return/exhaust fan, outdoor air flow measuring station and factory installed controls as required by this specification.

2.3 CASINGS

1. General:

a. Fabrication Requirements: Formed and reinforced single-wall panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
b. Exterior Material: Manufacturer's standard thickness galvanized steel with factory-painted finish, exterior color shall be manufacturer's standards, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
c. Interior Material for Intellipak units: Galvanized steel with no finish or factory standard finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections.
d. Unit height shall not exceed 84" excluding roof curb.

2. Fan Discharge Plenum Interior Material: Galvanized steel with no finish or factory standard finish. For sound sensitive areas such as classrooms and auditoriums section shall be perforated with 40 percent free area.

3. Insulation and Adhesive:

a. Comply with NFPA 90A or NFPA 90B.
b. Materials: ASTM C 1071, Type I.
c. Thickness: 2".
d. Materials in contact with air stream shall have air-stream surface coated with an erosion- and temperature-resistant coating or they shall be faced with a plain or coated fibrous mat or fabric.
e. Liner Adhesive: Comply with ASTM C 916, Type I.

B. Condensate Drain Pans:

1. Formed sections of stainless-steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1-2004.

2. Construction: Provide foam insulation on back. Double wall, foam insulated, moisture tight drain pans are acceptable.
3. Drain Connection(s): Threaded nipple with pan sloped in two directions to drain.
4. Length downstream of cooling coil: Provide pan at least ½ the height of air tunnel to ensure all carryover is collected and drained.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004 and UL 181.

2.4 ECONOMIZER SECTION

A. Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air

volume. The dampers shall be opposed blade design. Damper blades shall be as specified hereafter. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Control of the dampers shall be by factory installed actuators. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.

2.5 FANS

A. Supply Fan: Direct drive or belt driven plenum type with factory installed VFD or variable speed ECM motor. Provide with permanently lubricated, motor installed on an adjustable fan base resiliently mounted in the casing. Provide aluminum wheel and steel scroll.

B. Return/Exhaust/Relief Fan: Direct drive or belt driven plenum type with factory installed VFD or variable speed ECM motor. Provide with permanently lubricated, motor installed on an adjustable fan base resiliently mounted in the casing. Provide aluminum wheel and steel scroll.

C. Fan Shaft Bearings:

1. Prelubricated and Sealed, Ball Bearings: Self-aligning, pillow-block type with a rated life of 120,000 hours according to ANSI/ABMA 9

Or

2. Grease-Lubricated, Tapered-Roller Bearings: Self-aligning, pillow-block type with double-locking collars and 2-piece, cast-iron housing with grease lines extended to outside unit and a rated life of 120,000 hours according to ANSI/ABMA 11.

D. Fan Sound-Power Levels:
1. Fans, except condenser fans, shall meet or create lower sound power levels than those indicated.
2. Fans, except condenser fans, shall comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

E. Fan Performance Rating: Except condenser fans factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

F. Condenser Fan(s): Propeller mounted on shaft of permanently lubricated motor.

G. Fan Motor(s): Refer to section "Common Motor Requirements for HVAC Equipment."

2.6 COILS

A. Indoor Air Refrigerant Coil:

1. Aluminum fins, seamless copper tube with minimum 0.020" wall thickness, and equalizing vertical distributor.
2. Distribution: Interlaced.
3. Circuits: Minimum of one per compressor.
4. Casing: Galvanized steel.
5. Split: As indicated. If not indicated none required.

B. Outdoor Air Refrigerant Coil:

1. Aluminum fins, seamless copper tube with minimum 0.020" wall thickness, and equalizing vertical distributor.
2. Distribution: Interlaced.
3. Circuits: Manufacturer's standard.
4. Casing: Galvanized steel.
5. Split: As indicated. If not indicated Manufacturer's standard.

C. Hot Gas Reheat Coil:

1. Aluminum fins, seamless copper tube with minimum 0.020" wall thickness, and equalizing vertical distributor.
2. Distribution: Manufacturer's standard.
3. Circuits: Manufacturer's standard.
4. Casing: Galvanized steel.
5. Split: As indicated. If not indicated Manufacturer's standard.

2.7 COIL SECTION

A. Fabricate coil section to allow removal and replacement of coil(s) for maintenance and to allow in-place access for service and maintenance of coil(s).

B. Coils shall not act as a structural component of the unit.

2.8 REFRIGERANT CIRCUIT COMPONENTS

A. Provide gauge ports with Schrader valves for measuring suction and hot gas pressure.

B. Provide for operation of the unit for heating down to 0° F.

C. Provide for operation of the unit for cooling down to 35° F.

D. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

E. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.

4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves and unions installed in compressor suction and discharge lines.
9. Low-ambient kit high-pressure sensor.

2.9 AIR FILTRATION SECTION

A. Required sections: Provide filter sections indicated. If not otherwise indicated provide MERV 8 (30% efficient) 2" thick disposable pre-filters with MERV 13 (85% efficient) 4" thick final-filters.

B. Position: Final-filter shall be downstream of pre-filter

C. Refer to Division 23, Section "Particulate Air Filtration"

2.10 DAMPERS

A. General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2% of air quantity at 2000 FPM face velocity through damper and 4" WG pressure differential.

B. Minimum Outdoor Air Damper(s): Two position parallel or opposed blade galvanized steel motorized mechanically fastened to cadmium plated steel operating rods in reinforced cabinet, with bird screen and intake hood. Provide method of setting minimum outdoor air.

C. Economizer Outdoor Air Damper(s): Modulating opposed blade galvanized steel motorized mechanically fastened to cadmium plated steel operating rods in reinforced cabinet, with bird screen and intake hood. Provide method of setting economizer maximum equal to supply air

D. Return Air Damper(s): Two position (modulating if mechanically interlocked with mixing damper) parallel or opposed blade galvanized steel dampers mechanically fastened to cadmium plated steel operating rod in reinforced cabinet.

E. Mixing Damper(s): Modulating parallel blade galvanized steel dampers mechanically fastened to cadmium plated steel operating rod in reinforced cabinet. Operating rods may be connected with a common linkage and interconnected so return and mixing dampers operate simultaneously. Dampers shall be positioned such that airflows collide to promote mixing.

F. Relief Air Damper(s): Parallel or opposed blade galvanized steel motorized mechanically fastened to cadmium plated steel operating rods in reinforced cabinet, with bird screen and relief hood.

G. Damper Motors:

1. Fail closed.
   a. Exceptions:

1) Supply air damper shall fail open.
2) Return air damper shall fail open.

2. Modulating operation unless two-position is indicated.
3. Adjustable minimum position.

2.11 AIR FLOW MEASURING STATIONS

A. Provide factory standard outdoor airflow measuring station that can maintain +-5% accuracy at the velocity through hood at design outdoor air condition as scheduled on drawings.

B. Provide a 12" long plenum on the outdoor air intake, between the intake hood or louver and unit, for installation of an air flow measuring station.

1. Exception: Airflow measuring station manufacturer states "in writing" that plenum is not required for specified accuracy to be achieved.

C. Locate air flow measuring station(s) in unit opening(s) as indicated and make connection to unit control panel.

D. Airflow measuring station may be integral to outdoor air damper.

2.12 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

B. Provide electrical power phase monitoring to shut down unit if a phase is lost.

C. Power connection shall provide uninterrupted 115V power at 22 amps, regardless of voltage supplied to unit. When power is interrupted to unit, the outlet will continue to provide power.

1. Option: separate circuit to unit provided at no additional cost.

2.13 CONTROLS

A. Basic Unit Controls:

1. The manufacturer furnishing units and the contractor installing units under this section shall refer to, among others, Section "Building Automation System", Section "Sequences of Control", and the Seven (7) series control drawings for additional information regarding control of the equipment.

2. Provide control voltage transformer:

a. Primary Voltage: As required
b. Secondary Voltage: As required
c. Load: As required - 100 VA minimum

3. Unit Mounted Control Panel:

    a. Furnish under section "Building Automation System" and install under this Section.
    b. Interface control panel with BAS.
    c. Provide volatile memory backup.
    d. Provide software and firmware operational documentation including but not limited to:
        1) Software operating and upgrade manuals.
        2) Backup of Volatile Memory: On archival quality DVD or CD compliant disk, complete with data files.
        3) Device address list.
        4) Printout of software application and graphic

B. Refrigeration system control

1. The manufacturer furnishing equipment under this section shall provide all controls for the compressors and refrigeration system including but not limited to staging and safeties under this section.

C. Operation:

    a. Refer to section "Sequences of Operation"

2.14 ACCESSORIES

A. Low Ambient Operation: Provide low-ambient kit for operation down to 35° F.

B. Guards:

1. Provide coil guards of galvanized stamped steel, painted to match casing. Guards shall be on sides of unit. Coils shall not be clearly visible from any direction.

2.15 ROOF CURBS

A. Provide under this section.

B. Height: 8" greater than the highest portion of adjacent roof insulation.

C. Slope: Match structure. Top of curb shall be level and each edge shall be flush with other edges on all sides.

D. Roof Deck: Remove roof deck as required for ductwork and piping installation and insulation. Where pipe chases are provided remove roof deck inside curb and inside pipe chase.

E. Wood Blocking and Shimming: Not permitted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs or grade for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Mounted Unit:

1. Roof Curb
   a. Coordinate roof penetrations.
   b. Coordinate flashing with roof manufacturer.
   c. Install curb on roof structure, secure with anchor bolts and make top edges of curb level and all edges flush with each other.
   d. Secure equipment to upper curb rail (level) as recommended by equipment manufacturer.
   e. Install roof deck and roof insulation inside the curb under the equipment.
   f. Install roof curb below equipment pipe chase where pipe chase is required/provided.
   g. Eliminate roof deck and insulation below pipe chase where pipe chase is required/provided.
   h. Attach stainless steel wire mesh to deck over opening in pipe chase between roof and space below.

B. Coordination: Coordinate penetrations and flashing.

3.3 FIELD QUALITY CONTROL

A. Whether or not use of equipment is otherwise permitted, startup service, tests, and inspections must be complete prior to running unit. Failure to perform startup service, tests, and inspections prior to running equipment shall grant the owner's representative authority to have the units/equipment removed from the site at the Contractor's expense. This paragraph shall not be construed to grant the Contractor permission to use the unit(s)/equipment specified in this section of the specifications.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Record results.

C. Tests and Inspections:

1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Replace or repair faulty equipment.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. RTU's or components will be considered defective if unit or components do not pass tests and inspections.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Verify that unit is secure on mountings and supporting devices and connections to piping, ducts, and electrical systems are complete.
2. Verify that proper thermal overload protection is installed in motors, controllers, and switches.
3. Disconnect fan drive system. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operation. Reconnect fan drive system, align and adjust belts to proper tension.
4. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
5. Verify that dampers fully open and close.
6. Inspect dampers for proper stroke.
7. Inspect damper blades and seals for visible defects.
8. Inspect coil fins. Comb damaged coil fins for parallel orientation.
9. Verify that proper thermal overload protection is installed for electric coils.
10. Install new filters.
11. If not direct drive place new belts on coat hook attached with ¼" long stainless steel sheet metal screws inside unit adjacent to existing belts where no damage will occur. Including but not limited to fans.
12. If installed, verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.
13. If installed, verify that smoke dampers in connected duct system fully close when unit is deactivated.
14. Inspect for visible damage to unit casing.
15. If included in unit inspect furnace combustion chamber for visible damage.
16. Inspect coils, and fans for visible damage.
17. Inspect internal casing for visible damage.
18. Verify that labels are clearly visible.
19. Verify that clearances have been provided for servicing.
20. Verify that controls are connected and operable.

21. Clean condenser coil and inspect for construction debris.
22. If included in unit, clean furnace flue and inspect for construction debris.
23. Remove packing from vibration isolators.
24. Inspect fan wheel for operation without vibration and binding.
25. Start unit according to manufacturer's written instructions.
    a. Start cooling system.
    b. Do not operate below recommended ambient temperature.
    c. Complete startup sheets and attach 1 paper, and one "universally readable" electronic copy on USB flash drive, with startup report. Maintain a copy in electronic format, file type Portable Document Format (*.TXT, *.DOC, *.RTF, & *.PDF) file formats are acceptable. The file format must be one of those listed or the Owner and Architect must own a computer and software capable of reading the electronic file.
26. Inspect and record performance of interlocks and protective devices.
27. Verify sequence of operation.
28. Operate unit for an initial period as recommended or required by manufacturer.
29. Calibrate sensors including thermostats.
30. Adjust and inspect high-temperature limits.
31. With unit operating start cooling system, measure, and record the following when the ambient temperature is a minimum of 85° F:
    a. Coil leaving air, dry and wet bulb temperatures.
    b. Coil entering air, dry and wet bulb temperatures.
    c. Return air, dry and wet bulb temperatures.
    d. Outdoor air, dry and wet bulb temperatures.
    e. Outdoor air (condenser) coil, discharge air, dry bulb temperature.
32. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
    a. Supply air volume.
    b. Return air volume.
    c. Relief/exhaust air volume.
    d. Record relief/exhaust airflow station reading in CFM from BAS head end.
    e. Outdoor air intake volume.
    f. Record outdoor air intake airflow station reading in CFM from BAS head end.
33. Simulate maximum cooling demand by utilizing 100% outdoor air and lowering discharge air temperature. Record the discharge air temperature and outdoor air volume used for the simulation. During simulation operation inspect, measure, and record the following:
    a. Compressor refrigerant suction and hot gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

3.5 CLEANING AND ADJUSTING

A. Occupancy Adjustments: Within 12 months of the date of Substantial Completion, provide up to two (2) on site visits, during normal or other than normal occupancy hours as requested by owner, to assist in adjusting system.

B. After completing testing, adjusting, and balancing clean RTU's internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, filters.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units/equipment.

END OF SECTION 237413

SECTION 238126 – DUCTLESS MINI-SPLIT AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes ductless mini-split air-conditioning units consisting of separate evaporator-fan and compressor-condenser components. Evaporator fan units are designed for ceiling or wall mounting. The compressor-condenser unit shall be remote and located on the roof where indicated on the Drawings.

1.3 DEFINITIONS

A. Evaporator-Fan Unit: The part of the ductless mini-split air-conditioning unit that contains a coil for cooling and a fan to circulate air to conditioned space.

B. Compressor-Condenser Unit: The part of the ductless mini-split air-conditioning unit that contains a refrigerant compressor and a coil for condensing refrigerant.

1.4 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For ductless mini-split air-conditioning units to include in maintenance manuals specified in Division 1.

D. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of ductless mini-split units and are based on the specific system indicated. Other manufacturers' systems with equal performance characteristics may be considered.

B. Units shall be tested by a Nationally Recognized Testing Laboratory and shall bear the ETL label.

C. All wiring shall be in accordance with the governing version of the National Electrical Code.

D. Units shall be rated in accordance with ARI Standard 210 and bear the ARI Certification label.

E. Units shall be precharged with refrigerant for 70 feet of refrigerant tubing.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2010.

1.6 COORDINATION

A. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 7 Section "Sheet Metal, Flashings and Roofing Accessories."

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: One year from date of Substantial Completion. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. Warranty does not include labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Liebert Corporation
   2. Mitsubishi Electronics America, Inc.; HVAC Division.
   3. Sanyo HVAC.
   4. LG
   5. Carrier

2.2 WALL-MOUNTED, EVAPORATOR-FAN COMPONENTS

A. The evaporator section shall be designed to be wall-mounted by means of a factory supplied mounting plate. Air distribution shall be integral to the wall-mounted unit.

B. Cabinet and Chassis: Cabinet shall be high strength molded plastic with front panel access for the filter. Cabinet color shall be white. Include drain pan with drain connection. Indoor unit shall be factory assembled, wired and tested. Contained within unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit in conjunction with the wall mounted controller shall have a self-diagnostic function, three minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant piping shall be purged with dry nitrogen before shipment from the factory.

C. Refrigerant Coil: Evaporator coil shall be nonferrous construction with pre-coated aluminum fins on copper tubing. All tube joints shall be brazed with silver alloy. Coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

D. Fan and Motor: Evaporator fan shall be double inlet, forward curved, direct drive fan with a single motor. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall have two speeds: low and high.

E. Vane: Unit shall include a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower noise levels and shall close when unit stops.

F. Filters: Return air shall be filtered with a removable and washable filter.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. General: Outdoor unit shall be the same capacity as the indoor unit and include a control board that interfaces with the indoor unit to perform all necessary operation functions. Outdoor unit shall be capable of operating at 0˚F ambient temperature without additional low ambient controls. Outdoor unit shall be able to operate with a maximum height difference of 100 feet from indoor unit to outdoor unit and a maximum refrigerant tubing length of 165 feet between the indoor and outdoor unit without the need for line size changes, traps, or additional oil

B. Casing: Casing shall be galvanized steel plate coated with an electrostatically applied thermally fused acrylic or polyester powder coating. The fan grille shall be ABS plastic.

C. Compressor: The compressor shall be a DC rotary compressor with variable compressor speed inverter technology. The compressor shall be driven by inverter circuitry to control compressor speed. Compressor speed shall be varied to match space load. Outdoor unit shall include an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

D. Refrigerant Coil: Condenser coil shall be copper tubing with aluminum fins. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be controlled by a microprocessor-controlled step motor.

E. Fan: The fan motor bearings shall be permanently lubricated. The fan shall have horizontal discharge airflow. The fan shall be mounted in front of the coil. The fan shall include a raised guard to prevent contact with moving parts.

2.4 ACCESSORIES

1. Control: The control system shall be microprocessor-based and include one microprocessor on the outdoor unit and one on the indoor unit. Wall-mounted controller shall a have a liquid crystal display indicating operating status and alarm condition and shall include a temperature sensor. A membrane keypad shall be included for program control and set point adjustment.
2. The controller shall consist of On/Off button, increase/decrease set temperature buttons, a cool/dry/fan mode selector, timer menu button, timer on/off button, set time buttons, fan speed selector, vane position selector, a ventilation button, a test run button, and a check mode button.
3. The controller shall display operating conditions such as set temperature, room temperature, pipe temperatures (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions (including running current, frequency, input voltage, On/Off status and operating time), LEV opening pulses, sub-cooling and discharge super heat.
4. Normal operation of the controller shall provide individual system control in which one controller and one indoor unit are installed in the same room.
5. The control voltage from the controller to the indoor unit shall be 12 volts, DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Up to two wired controllers shall be able to be used to control one unit.
6. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off and mode switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay.

B. Refrigerant Line Sets: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends. Pre-charge line sets in proper lengths for application. Final length shall be field verified. Refer to section "Refrigerant Piping" for additional requirements.

C. Factory-installed and –wired disconnect to be provided under this Section.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, firmly anchored, in accordance with the manufacturer's written recommendations.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted compressor-condenser components on equipment supports specified in Division 7 Section "Sheet Metal, Flashings and Roofing Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Install compressor-condenser components on Elastomeric pads. Refer to Division 15 Section "Vibration Control for HVAC."

E. Connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect condensate drain piping. Unit drain shall be internally trapped.

C. Install piping adjacent to unit to allow service and maintenance.

D. Unless otherwise indicated, connect piping with unions and shutoff valves to allow units to be disconnected without draining piping. Refer to piping system Sections for specific valve and specialty arrangements.

E. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Installation Inspection: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to prepare a written report of inspection.

B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 COMMISSIONING

A. Engage a factory-authorized service representative to perform startup service.

B. Verify that units are installed and connected according to the Contract Documents.

C. Lubricate bearings, adjust belt tension, and change filters.

D. Perform startup checks according to manufacturer's written instructions and do the following:

1. Fill out manufacturer's checklists.
2. Check for unobstructed airflow over coils.
3. Check operation of condenser capacity-control device.
4. Verify that vibration isolation devices and flexible connectors dampen vibration transmission to structure.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units.
2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 238126

SECTION 238239 - UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract Documents apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cabinet unit heaters with centrifugal fans and electric-resistance heating coils.
2. Propeller unit heaters with electric-resistance heating coils.
3. Wall heaters with propeller fans and electric-resistance heating coils.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. PTFE: Polytetrafluoroethylene plastic.

C. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. Samples for Initial Selection: Finish colors for units with factory-applied color finishes.

C. Samples for Verification: Finish colors for each type of cabinet unit heater and wall and ceiling heaters indicated with factory-applied color finishes.

D. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 2 - PRODUCTS

2.1 PROPELLER UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airtherm; a Mestek Company.
2. Carrier Corp.
3. Daikin Applied (McQuay International)
4. Dunham-Bush, Inc.
5. Engineered Air.
6. International Environmental Corp.
7. Ruffneck Heaters, Starozik Industries Ltd.
8. Trane.
9. USA Coil & Air Inc.

B. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

C. Comply with UL 2021.

D. Cabinet: Removable panels for maintenance access to controls.

E. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

G. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

H. Hot-Water Coil: Copper tube, 0.031-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering water temperature of 325 deg F , with manual air vent. Test for leaks to 375 psig underwater.

I. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

J. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Type: Permanently lubricated, multispeed.

K. Control Devices:

1. Unit-mounted, fan-speed switch.
2. Unit-mounted thermostat.

2.2 WALL HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berko; Marley Engineered Products.
2. Chromalox, Inc.; a division of Emerson Electric Company.
3. Indeeco.
4. Markel Products; a division of TPI Corporation.
5. Marley Electric Heating; a division of Marley Engineered Products.
6. QMark Electric Heating; a division of Marley Engineered Products.
7. Trane.

B. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

C. Cabinet:

1. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
2. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

D. Surface-Mounting Cabinet Enclosure: Steel with finish to match cabinet.

E. Hot-Water Coil: Copper tube, 0.031-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering water temperature of 325 deg F , with manual air vent. Test for leaks to 375 psig underwater.

F. Fan: Aluminum propeller directly connected to motor.

1. Motor: Permanently lubricated. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

G. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit.

H. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for electrical connections to verify actual locations before unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinet unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature set points.

END OF SECTION 238239

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:
1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cerro Wire LLC.
2. General Cable; General Cable Corporation.

3. Southwire Company.
4. Encore Wiring Corporation.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. 3M.
2. Hubbell Power Systems, Inc.
3. ILSCO.
4. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

F. Branch Circuits Concealed in Casework: MC cable may be used to feed to outlet boxes fish concealed in built-in casework. Route cable supported tight in upper inside corners of casework, not in conflict with drawers or cabinet doors.

G. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

H. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

I. Whips from Junction Box Concealed in Ceilings to Lighting Fixtures:

1. Type MC Cable or FMC, with minimum #12AWG copper THHN/THWN and full-size equipment grounding conductor. Maximum whip length 72".
2. MC Cable and FMC shall be supported within 24" of fixture connection so that whip is not in contact with ceiling or grid. Securing to fixture support wires with batwings is acceptable but not to ceiling support wires.
3. Do not connect fixture whips from fixture to fixture (daisy chain). No more than 4 whips shall be connected to any one junction box.

J. All single-phase circuits shall include a dedicated neutral (grounded) and grounding conductor, unless specifically noted otherwise.
1. The intent of this is to eliminate multiwire branch circuits and allow disconnection of one circuit without requiring disconnection of other(s) as would be required to comply with NEC 210.4(B). Per NEC 310.15(B)(b) each of these neutral (grounded) conductor is not considered to be load-bearing so derating is not required.

K. Contract drawings are based upon a maximum of 3 current-carrying conductors in a conduit. Contractor may rework indicated circuitry to install a maximum of (6) L-N circuits (120 or 277V) in a single conduit. There shall be no more than 2 each A, B, C phase conductors per homerun. Each shall have dedicated neutral (grounded) conductor.
1. Do not group L-L circuits in a homerun, unless specifically indicated on the drawings.
2. Where there are more than 3 current-carrying conductors in a conduit, derate conductor ampacities in accordance with NEC Table 310.15(B)(2)(a).
3. When running more than 3 ungrounded conductors in a raceway, increase size of conduits beyond those indicated in contract documents, as required to not exceed NEC Chapter 9, Table 1 conduit-fill requirements. As-built drawings shall clearly indicate which circuits are grouped in homeruns.

L. Unless otherwise indicated, minimum conductor size shall be 12 AWG.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Instructions for periodic testing and inspection of grounding features at test wells, ground rings and grounding connections for separately derived systems based on NETA MTS.

1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Galvan Industries, Inc.; Electrical Products Division, LLC.
4. ILSCO.
5. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Ductbank Grounding Conductor: Bury 12 inches above ductbank when indicated as part of duct-bank installation.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Handholes: Install a driven ground rod through handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Metal-clad cable runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

F. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation.

J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper B-Line, Inc.; a division of Cooper Industries.
b. ERICO International Corporation.
c. Thomas & Betts Corporation.
d. Unistrut; an Atkore International company.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Hilti, Inc.
2) MKT Fastening, LLC.
3) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Hilti, Inc.
3) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 9 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.
5. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Allied Tube & Conduit.
2. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
3. Robroy Industries.
4. Thomas & Betts Corporation.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. FMC: Comply with UL 1; zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:

a. Material: Steel.
b. Type: compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

H. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. AFC Cable Systems, Inc.
2. Electri-Flex Company.
3. RACO; Hubbell.
4. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660.

E. Rigid HDPE: Comply with UL 651A.

F. RTRC: Comply with UL 1684A and NEMA TC 14.

G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

H. Fittings for LFNC: Comply with UL 514B.

I. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. EGS/Appleton Electric.
2. Erickson Electrical Equipment Company.
3. Hoffman; a brand of Pentair Equipment Protection.
4. Hubbell Incorporated.
5. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
6. RACO; Hubbell.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

K. Gangable boxes are allowed.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.5 FLOOR BOXES AND SERVICE FITTINGS

A. Basis of Design: Wiremold, RFB4 Series Floor Boxes.

1. Floor boxes mounted on first floor grade shall be manufactured from cast-iron and be approved for use on grade. The box shall be 14 1/2" L x 11 7/8" W x 3 7/16" H. There shall be four independent wiring compartments that allow capacity for up to four duplex receptacles and/or communication services. The RFB4-CI-1 Series Box shall permit tunneling from adjacent or opposite compartments. Two of the four compartments shall have a minimum wiring capacity of 27 cu in., and two compartments shall have a minimum wiring capacity of 36 cu in.. The box shall provide the following number of conduit hubs: four 1" and four 1 1/4". The box shall be fully adjustable, providing a maximum of 1 7/8" pre-pour adjustment, and a maximum of 3/4" after-pour adjustment. Wiremold RFB4-CI-1.

2. Activation covers shall be available in flanged and flangeless versions of cast aluminum with bronze finish. Covers shall be available with options for tile or carpet inserts, flush covers, or furniture feed. Flanged covers shall be 7 3/4" L x 6 9/16" W.
   a. Unless indicated otherwise, provide the following cover configurations:
      1) Power/Telecom Outlets: Brass flanged with blank lid flush with floor and NO carpet/tile cutouts.
      2) Furniture Floor Feed: Brass flanged with 1" trade size screw plug opening and one combination 1 1/4" and 2" trade size screw plug openings.

2.6 POKE-THRU ASSEMBLIES

A. Basis of Design: Wiremold, Evolution Series Poke-Thru Device

1. Recessed Outlet Poke-Thru Devices: 8AT Poke-Thru Devices.

2. Poke-thru devices provide an interface between power, communication and audio/visual (A/V) cabling in an above grade concrete floor and the workstation or activation location where power, communication and/or A/V device outlets are required. These devices provide recessed device outlets that will not obstruct the floor area.

3. 8AT Poke-Thru Assembly: Poke-thru device assemblies shall consist of an insert and an activation cover. Assembly length: 16-3/4 inches (425mm).

4. Insert: Insert body shall recess the devices a minimum of 2-3/4 inches (69mm) and have a polyester based backing enamel finished interior; ivory color. Furnish with necessary channels to provide complete separation of power and communication services. Provide five (5) compartments that allow for up to five (5) duplex receptacles that can be wired as a standard receptacle or isolated ground and/or 22 communication ports and/or 16 AV devices.
   a. Body consists of an intumescent firestop material to maintain fire rating of the floor slab. Hold intumescent material securely in place in insert body. Intumescent material will not have to be adjusted to maintain fire rating of the unit and the floor slab. Provide insert with a retaining feature to hold the poke-thru device in the floor slab without additional fasteners. Poke-thru insert shall also consist of a 3/4-inch trade size conduit stub that is connected to the insert body and

a 24.5 cu in (402ml) stamped steel junction box for wire splicing and connections. Stamped steel junction box shall also contain the means necessary to electrically ground the poke-thru device to the system ground.

5. Activation Cover: Manufactured of die-cast aluminum alloy; finished in powder-coated brass. 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. Activation cover is 9-1/4 inches (235mm) in diameter. Provide cover with spring-loaded slides to allow cables to egress out of the unit and maintain as small an egress opening as possible.

6. Communication Modules Mounting Accessories: Provide activation unit with three locations to mount communication connectors. Mount connectors using a mounting bracket capable of accepting up to 12 Category 6 insert modules or Category 6 discrete keystone connectors. Also provide unit with two (2) Category 6 discrete keystone connectors and two (2) industry standard keystones and accommodate a mechanism to permit protection of communication cabling. Fabricate mechanism from stamped steel construction. Mechanism shall accept both flexible and rigid 3/4-inch, 1-1/4-inch or two-inch trade size conduit.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. Quazite: Hubbell Power Systems, Inc.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, **"ELECTRIC" "COMMUNICATION".**
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Carport.
    b. Mechanical rooms.
    c. Inmate Areas.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways 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 compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. All conduit to be installed on exterior masonry shall not run continuously within the wall cavity.

I. Support conduit within 12 inches of enclosures to which attached.

J. Raceways Embedded in Slabs:

1. Are not permitted, except as required for entry into recessed floor boxes.
2. Conduits run below slab on ground floor level shall be buried within the porous fill and stub-up at the required location. Transition from RNC to RGS with RGS elbow before rising above the floor. After RGS elbow, stub-up conduit shall be type indicated in Part 3.1 above.
3. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to GRC before rising above floor.

K. Stub-ups to Above Recessed Ceilings:

1. Use EMT or RMC for raceways.

2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways 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 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. 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 raceways designated as spare above grade alongside raceways in use.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental

temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements, and also refer to Architectural elevations. Install boxes with height measured to center of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Locate boxes so that cover or plate will not span different building finishes.

BB. 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.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

DD. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07.

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Direct-buried conduit, ducts, and duct accessories.
2. Concrete-encased conduit, ducts, and duct accessories.
3. Handholes and boxes.
4. Manholes.

1.3 DEFINITIONS

A. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include ductbank materials, including separators and miscellaneous components.
2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for manholes, handholes, boxes.
4. Include warning tape.

B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:

a. Include plans, elevations, sections, details, attachments to other work, and accessories.
b. Include duct entry provisions, including locations and duct sizes.
c. Include reinforcement details.
d. Include frame and cover design and manhole frame support rings.
e. Include grounding details.
f. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
g. Include joint details.

2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:

   a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
   b. Include duct entry provisions, including locations and duct sizes.
   c. Include cover design.
   d. Include grounding details.
   e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

   1. Notify Owner no fewer than ten business days in advance of proposed interruption of electrical service.
   2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Ground Water: Assume ground-water level is 12 inches below ground surface unless a higher water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

A. Comply with ANSI C2.

B. Install underground conduits and ductbanks per the table below. Locate a minimum of 3 feet from other utility systems (steam, chilled water, sewer, storm, etc.).
   1. Install not less than 4- #4 reinforcing bars tied to a square cage at 8' centers for conduits in ductbank under roadways.
   2. Concrete encased with a minimum envelope of 3" around each conduit where encasement is required.

2.2 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ARNCO Corp.
2. Electri-Flex Company.
3. Lamson & Sessions.
4. Spiraduct/AFC Cable Systems, Inc.

B. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512 Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.

C. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Christy Concrete Products.
2. Oldcastle Precast, Inc.
3. Utility Concrete Products, LLC.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
2. Configuration: Units shall be designed for flush burial.
3. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

    a. Extension shall provide increased depth of 12 inches.
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

4. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.5 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. General Requirements for Handholes and Boxes: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

1. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
2. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
3. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. Quazite: Hubbell Power Systems, Inc.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers made of polymer concrete , reinforced concrete, cast iron, hot-dip galvanized-steel diamond plate, or fiberglass.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Carson Industries LLC.
b. Christy Concrete Products.
c. Nordic Fiberglass, Inc.
d. Quazite: Hubbell Power Systems, Inc.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

3.2 PREPARATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 311000 "Site Clearing."

3.3 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Feeders and Branch circuits, 600 V and Less: RNC, NEMA Type EPC-40 PVC, in concrete-encased duct bank unless otherwise indicated.

B. Underground Ducts Crossing Paved Paths, Walks, Driveways, Roadways Parking lots and Railroads: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.4 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, with structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, or Fiberglass enclosures with polymer concrete frame and cover, with structural load rating.
3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Fiberglass units with polymer concrete frame and cover, with structural load rating.
4. Cover design load shall not exceed the design load of the handhole or box.

3.5 EARTHWORK

A. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

B. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

C. Cut and patch existing pavement in the path of underground ducts and utility structures

3.6 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius, both horizontally and vertically, at other locations unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch.
3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

G. Pulling Cord: Install 100-lbf- test nylon cord in empty ducts.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms for pipes less than 6 inches in nominal diameter.
2. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
3. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

4. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than five spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
5. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
6. Elbows: Use manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.

7. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
8. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
9. Concrete Cover: Install a minimum of 3 inches of concrete cover at top and bottom, and a minimum of 2 inches on each side of duct bank.
10. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.

11. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

I. Direct-Buried Duct Banks:

1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
3. Space separators close enough to prevent sagging and deforming of ducts, with not less than [four] [five] spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
4. Depth: Install top of ductbank at least 36 inches below finished grade unless otherwise indicated. Set elevation of bottom of ductbank below frost line.

5. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
6. Elbows: Install manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
7. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

8. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.

    a. Place minimum 3 inches of sand as a bed for duct bank. Place sand to a minimum of 6 inches above top level of duct bank.
    b. Place minimum 6 inches of engineered fill above concrete encasement of duct bank.

J. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm

lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and other surfaces subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame

3.8 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Advance Products & Systems, Inc.
b. Metraflex Company (The).
c. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, water-stop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber water-stop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. HOLDRITE.

2.4 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

C. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

D. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water-stop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's

wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.2 METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Colors for Cables Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

2.5 FLOOR MARKING TAPE

A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

C. Warning Tape:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 28 lb/1000 sq. ft..
5. 3-Inch Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

2.9 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.10 CABLE TIES

A. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one-piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

B. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.11 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Grounded (Neutral): White.
5) Ground: Green.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Grounded (Neutral): Gray.
5) Ground: Green.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.

F. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes or self-adhesive, self-laminating polyester labels with the conductor designation.

G. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

M. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and load shedding.

N. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Adhesive film label with clear protective overlay. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
e. Emergency system boxes and enclosures.
f. Enclosed switches.
g. Enclosed circuit breakers.
h. Enclosed controllers.
i. Variable-speed controllers.
j. Push-button stations.
k. Power transfer equipment.
l. Contactors.
m. Remote-controlled switches, dimmer modules, and control devices.
n. Power-generating units.
o. Monitoring and control equipment.
p. UPS equipment.

END OF SECTION 260553

SECTION 260572 - OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1. All revisions required to the study upon receiving recommendations and incorporating associated plan revisions shall be included at no additional cost.

1.3 DEFINITIONS

A. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

B. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

C. SCCR: Short-circuit current rating.

D. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

1. Short-circuit study input data, including completed computer program input data sheets.
2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in

equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Short-Circuit Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. EDSA Micro Corporation.
2. Power Analytics, Corporation.
3. SKM Systems Analysis, Inc.

B. Comply with IEEE 399 and IEEE 551.

C. Analytical features of fault-current-study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.

G. Short-Circuit Study Output:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.

d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Obtain all data necessary for the conduct of the study.

1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Architect.
2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.

7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:

1. Electric utility's supply termination point.
2. Incoming Main Distribution Panelboard.
3. Standby generators and automatic transfer switches.
4. Branch circuit panelboards.
5. Disconnect switches.

3.3 ADJUSTING

A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.4 DEMONSTRATION

A. Train Owner's operating and maintenance personnel in the use of study results.

END OF SECTION 260572

SECTION 260573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.
   1. All revisions required to the study upon receiving recommendations and incorporating associated plan revisions shall be included at no additional cost.

1.3 DEFINITIONS

A. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

B. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

C. SCCR: Short-circuit current rating.

D. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

   1. Coordination-study input data, including completed computer program input data sheets.
   2. Study and equipment evaluation reports.
   3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. The following parts from the Protective Device Coordination Study Report:

1) One-line diagram.
2) Protective device coordination study.
3) Time-current coordination curves.

b. Power system data.

1.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers: Subject to compliance with requirements, provide software by one of the following:

1. ESA Inc.
2. Power Analytics, Corporation.
3. SKM Systems Analysis, Inc.

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

2.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

    a. Phase and Ground Relays:

        1) Device tag.
        2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
        3) Recommendations on improved relaying systems, if applicable.

    b. Circuit Breakers:

        1) Adjustable pickups and time delays (long time, short time, ground).
        2) Adjustable time-current characteristic.
        3) Adjustable instantaneous pickup.
        4) Recommendations on improved trip systems, if applicable.

    c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

    a. Power utility's overcurrent protective device.
    b. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    c. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    d. Cables and conductors damage curves.
    e. Ground-fault protective devices.
    f. Motor-starting characteristics and motor damage points.
    g. Generator short-circuit decrement curve and generator damage point.
    h. The largest feeder circuit breaker in each motor-control center and panelboard.
5. Provide adequate time margins between device characteristics such that selective operation is achieved.
6. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.

K. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Unit substation primary and secondary terminals.
3. Main Distribution Panelboard.
4. Standby generators and automatic transfer switches.
5. Branch circuit panelboards.

M. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of Panelboard bus bars to withstand short-circuit stresses.
3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain

device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.4 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.5 DEMONSTRATION

A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.
2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.
3. Adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 260573

SECTION 260574 - OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1. All revisions required to the study upon receiving recommendations and incorporating associated plan revisions shall be included at no additional cost.

1.3 DEFINITIONS

A. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

B. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

C. SCCR: Short-circuit current rating.

D. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals may be in digital form.

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

B. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. EDSA Micro Corporation.
2. Power Analytics, Corporation.
3. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Distributuion panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

F. Arc-Flash Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

G. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.

4. Arc-flash boundary.
5. Working distance.
6. Incident energy.
7. Hazard risk category.
8. Recommendations for arc-flash energy reduction.

H. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Flash protection boundary.
4. Hazard risk category.
5. Incident energy.
6. Working distance.
7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies:
1. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

C. Calculate maximum and minimum contributions of fault-current size.

1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.

3.4 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:
1. Distribution Panelboards

2. Panelboards
3. Control panel.

3.5 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.6 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION 260574

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Indoor occupancy sensors.
4. Outdoor motion sensors.
5. Lighting contactors.
6. Emergency shunt relays.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Leviton Manufacturing Co., Inc.
4. NSi Industries LLC.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
6. Astronomic Time: All channels.
7. Automatic daylight savings time changeover.
8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC.
4. Tyco Electronics.

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.

4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

C. Description: Solid state, with SPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
3. Time Delay: Thirty-second minimum, to prevent false operation.
4. Lightning Arrester: Air-gap type.
5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.3 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hubbell Building Automation, Inc.
2. Leviton Manufacturing Co., Inc.
3. Lithonia Lighting; Acuity Brands Lighting, Inc.
4. Lutron Electronics Co., Inc.
5. Sensor Switch, Inc.
6. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage:
   a. **Standard Height Units**: In areas that have ceiling heights of 12 feet or lower, provide Watt Stopper unit DT-300 (or approved equal): Detect occupancy anywhere within a circular area up to 2000 square feet. Detectors shall be networkable to allow coverage of larger or irregularly shaped areas.
   b. **High Ceiling Units**: In areas that have ceiling/mounting height over 12 feet up to 40 foot mounting provide Watt Stopper unit HB3x0 with L4 lens, or approved equal. Detect occupancy anywhere within a circular area up to 3500 square feet. Detectors shall be networkable to allow coverage of larger or irregularly shaped areas.

2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hubbell Building Automation, Inc.
2. Leviton Manufacturing Co., Inc.
3. Lutron Electronics Co., Inc.
4. Sensor Switch, Inc.
5. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor 180 degree:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft..
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, dual circuit.
4. Voltage: Dual voltage, 120 and 277 V; dual-technology type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

D. Wall-Switch Sensor 210 degree:

1. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft..
2. Sensing Technology: PIR.
3. Switch Type: SP, dual circuit.
4. Voltage: Dual voltage, 120 and 277 V; dual-technology type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.5 OUTDOOR MOTION SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hubbell Building Automation, Inc.
2. Leviton Manufacturing Co., Inc.
3. Sensor Switch, Inc.
4. Watt Stopper.

B. General Requirements for Sensors: Solid-state outdoor motion sensors.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Dual-technology (PIR and infrared) type, weatherproof. Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.. Comply with UL 773A.
3. Switch Rating:

    a. Lighting-Fixture-Mounted Sensor: 500-VA fluorescent or LED.
    b. Separately Mounted Sensor: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.

4. Switch Type: SP, dual circuit.
5. Voltage: Dual voltage, 120- and 277-V type.
6. Detector Coverage:

    a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft.
    b. Long Range: 180-degree field of view and 110-foot detection range.

7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
8. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
9. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
10. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
11. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as "raintight" according to UL 773A.

2.6 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP.
3. General Electric Company.
4. Square D.

B. Description: Electrically operated and mechanically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

C. Interface with DDC System for HVAC: Provide hardware interface to enable the DDC system for HVAC to monitor and control lighting contactors.

2.7 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Lighting Control and Design.
2. Watt Stopper.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: 120 V.

2.8 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller thanNo. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide one visit to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 260943 - RELAY-BASED LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Lighting control panels using mechanically held relays for switching.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. IP: Internet protocol.

C. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

D. PC: Personal computer; sometimes plural as "PCs."

E. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, relays, manual switches and plates, and conductors and cables.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each relay panel and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail wiring partition configuration, current, and voltage ratings.
4. Short-circuit current rating of relays.
5. Include diagrams for power, signal, and control wiring.

6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring, and interface devices that prove compatibility of inputs and outputs.
2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the network protocol.

B. Field quality-control reports.

C. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panels for installation according to NECA 407.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Input signal from field-mounted manual switches, or digital signal sources, shall open or close one or more lighting control relays in the lighting control panels. Any combination of inputs shall be programmable to any number of control relays.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with UL 916.

2.2 LIGHTING CONTROL RELAY PANELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. General Electric Co.
2. Leviton Manufacturing Co., Inc.
3. Lithonia Lighting; Acuity Brands Lighting, Inc.
4. WattStopper.

B. Description: Standalone lighting control panel using mechanically latched relays to control lighting and appliances.

C. Lighting Control Panel:

1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
2. A vertical barrier separating branch circuits from control wiring.

D. Control Unit: Contain the power supply and electronic control for operating and monitoring individual relays.

1. Timing Unit:

a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
c. Four independent schedules, each having 24 time periods.
d. Schedule periods settable to the minute.
e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
f. 10 special date periods.

2. Sequencing Control with Override:

a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
d. Override control "blink warning" shall warn occupants approximately five minutes before actuating the off sequence.

3. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation, including accurate time of day and date.

E. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 277 V. Short-circuit current rating shall be not less than 5 kA. Control shall be three-wire, 24-V ac.

F. Power Supply: NFPA 70, Class 2, sized for connected equipment, plus 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and photo sensors.

G. Operator Interface:

1. Integral alphanumeric keypad and digital display, and intuitive drop-down menus to assist in programming.
2. Log and display relay on-time.
3. Connect relays to one or more time and sequencing schemes.

2.3 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panels according to NECA 407.

B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters.
   1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 PANEL INSTALLATION

A. Comply with NECA 1.

B. Install panels and accessories according to NECA 407.

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panel cabinet plumb and rigid without distortion of box.

E. Install filler plates in unused spaces.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.

D. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

B. Acceptance Testing Preparation:

1. Test continuity of each circuit.

C. Lighting control panel will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

END OF SECTION 260943

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Distribution, dry-type transformers rated 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. Siemens Power Transmission & Distribution, Inc.
3. Square D; by Schneider Electric.

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

C. All panelboards, switchboards, circuit breakers, dry type transformers and disconnect switches shall be of the same manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Transformers Rated 15 kVA and Larger: Comply with 10 CFR Part 431 (2016), DOE 2016 energy-efficiency levels as verified by testing according to NEMA TP 2.

D. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

E. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Aluminum.

F. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.

G. Shipping Restraints: Paint or otherwise color code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated.

1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound utilizing a vacuum pressure impregnation process to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.

D. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: Gray.

E. Taps for Transformers 3 kVA and Smaller: None.

F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above, and one 5 percent tap below normal full capacity.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

H. Insulation Class, Smaller than 30 kVA: 185 deg C, UL-component-recognized insulation system with a maximum of 115-deg C rise above 40-deg C ambient temperature.

I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150-deg C rise above 40-deg C ambient temperature.

J. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.

K. Wall Brackets: Manufacturer's standard brackets.

L. Fungus Proofing: Permanent fungicidal treatment for coil and core.

M. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:

1. 9 kVA and Less: 40 dBA.
2. 30 to 50 kVA: 45 dBA.
3. 51 to 150 kVA: 50 dBA.

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of all windings at the rated voltage connections and at all tap connections.
2. Ratio tests at the rated voltage connections and at all tap connections.
3. Phase relation and polarity tests at the rated voltage connections.
4. No load losses, and excitation current and rated voltage at the rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at the rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation Resistance Tests:

    a. High voltage to ground.
    b. Low voltage to ground.
    c. High-voltage to low-voltage.

9. Temperature tests.

B. Factory Sound-Level Tests: Conduct prototype sound-level tests on production-line products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure transformer to concrete base according to manufacturer's written instructions.

E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS for dry-type, air-cooled, low-voltage transformers. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Disconnecting and overcurrent protective devices.
3. Instrumentation.
4. Control power.
5. Accessory components and features.
6. Identification.

1.3 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Detail utility company's metering provisions with indication of approval by utility company.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Routine maintenance requirements for switchboards and all installed components.
b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.

C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.8 FIELD CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F.
b. Altitude: Not exceeding 6600 feet.

C. Unusual Service Conditions: NEMA PB 2, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.9 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, bus-work, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SWITCHBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Power Transmission & Distribution, Inc.
4. Square D; by Schneider Electric.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. All feeder breakers in switchboards shall have LSI (long time, short time and instantaneous) settings.

D. All panelboards, switchboards, circuit breakers, dry type transformers and disconnect switches shall be of the same manufacturer.

E. 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.

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

I. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

J. Nominal System Voltage: 480Y/277 V.

K. Main-Bus Continuous: 1600 A.

L. Indoor Enclosures: Steel, NEMA 250, Type 1.

M. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

N. Barriers: Between adjacent switchboard sections.

O. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.

P. Utility Metering Compartment: Barrier compartment and section complying with utility company's requirements; hinged sealable door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

Q. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

R. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

S. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated.
3. Copper feeder circuit-breaker line connections.

4. Ground Bus: 1/4-by-2-inch-hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
5. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
6. Disconnect Links:

    a. Isolate neutral bus from incoming neutral conductors.
    b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
7. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
8. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

T. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

U. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long and short time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.
4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching LED lighting loads.

d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [**55**] [**75**] percent of rated voltage.
f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

7. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Sector; Eaton Corporation.
b. Siemens Industry, Inc.
c. Square D.

8. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
9. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
   a. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.

10. Auxiliary Switches: Factory installed, SPDT, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
11. Service-Rated Switches: Labeled for use as service equipment.
12. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

    a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

13. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

2.3 INSTRUMENTATION

A. Instrument Transformers: NEMA EI 21.1, and the following:

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

   a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
   b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
   c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
   d. Megawatts: Plus or minus 1 percent.
   e. Megavars: Plus or minus 1 percent.
   f. Power Factor: Plus or minus 1 percent.
   g. Frequency: Plus or minus 0.1 percent.

h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.

2. Mounting: Display and control unit flush or semi-flush mounted in instrument compartment door.
3. Integral demand indicator.
4. Contact devices to operate remote impulse-totalizing demand meter.
5. Ratchets to prevent reverse rotation.
6. Removable meter with drawout test plug.
7. Semi-flush mounted case with matching cover.
8. Appropriate multiplier tag.

2.4 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.5 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
3. Protect from moisture, dust, dirt, and debris during storage and installation.
4. Install temporary heating during storage per manufacturer's instructions.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after switchboard is anchored in place.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to switchboards.
6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, surge protection devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Comply with NECA 1.

3.3 CONNECTIONS

A. Comply with requirements for terminating feeder bus specified in Section 262500 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

B. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.

C. Support and secure conductors within the switchboard according to NFPA 70.

D. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting, and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Acceptance Testing:

    a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
    b. Test continuity of each circuit.

2. Test ground-fault protection of equipment for service equipment per NFPA 70.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Switchboard will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include wiring diagrams for power, signal, and control wiring.
6. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

1. Test procedures used.

2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

B. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Series rating of panelboards is not acceptable.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.9 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.10 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. All panelboards, circuit breakers, dry type transformers and disconnect switches shall be of the same manufacturer.

B. All breakers over 60A and all main breakers in panelboards on the normal power, life safety, legally required and optional standby systems shall have LSI (long time, short time and instantaneous) settings.

C. Enclosures: Flush and surface-mounted cabinets as indicated on the drawings.

1. Rated for environmental conditions at installed location.

    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
2. Piano Type Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

3. Finishes:

    a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel.
    c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

4. Directory Card: Inside panelboard door, mounted in transparent card holder.

D. Incoming Mains Location: Top or bottom to match incoming conduit location.

E. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

F. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

G. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

H. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

J. All doors shall be keyed alike.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only per drawings.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Siemens Industry, Inc.
2. General Electric Company.
3. Square D.
4. Eaton Electrical Sector; Eaton Corporation.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only per the drawings.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I squared x t response.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    d. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at **55** percent of rated voltage.
    e. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. 90 inches to top of trim above finished floor unless otherwise indicated or as required to ensure that the operating handle of the top most switch or circuit breaker is not higher than 79" above the finished floor level.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262714 - UTILITY SERVICE ENTRANCE (DVP)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract Documents apply to the work of this section.

1.2 SUMMARY

A. This Section includes work required to allow Utility Company to provide power to the project, as well as provisions for Utility Company metering.

B. The power company will furnish 480/277 volt, three phase, 4-wire, 60-Hz underground service.

1.3 COORDINATION

A. Electrical service will be supplied by Dominion Virginia Power Company, herein referred to as "the power company."

B. All work shall be in accordance with the Dominion Virginia Power Company "Blue Book." This shall not modify the scope of work indicated in the Contract Documents; only clarify the means and methods to be in compliance with Utility requirements. Communicate to the Architect any variance from the Contract Documents required by the Utility prior to bid.

C. Coordinate work with the power company within 30 days of notice to proceed. Notification shall be in writing with a brief construction schedule included. Subsequent to notification, schedule a preconstruction meeting be held at the power company's District Office or other location and time acceptable to the power company. Representatives of the general Contractor and appropriate sub-contractors shall attend. A power company Construction Department representative will review the proposed construction schedule and discuss any construction practices and/or methods applicable to the project. No work shall commence until construction schedule and ductbank installation drawings are approved by the power company.

D. The Contractor shall notify the power company at least seven days prior to beginning of duct bank construction.

E. Equipment fault current ratings shown on the documents are based on preliminary information provided by the Power Company and are shown for bidding purposes only. Exact available fault current values at the service connection point will be determined by the Power Company after the project is awarded. Verify equipment fault current interrupting capacity requirements prior to ordering electrical distribution equipment in accordance with Section 260572 "Overcurrent Protective Device Short Circuit Study." Provide a copy of the Power Company's calculated maximum available fault current to the Architect.

PART 2 - PRODUCTS

2.1 SPECIFICATION

A. Products required by this Section are specified in other Sections, or are furnished/specified by the Utility Company.

2.2 UTILITY COMPANY PROVIDED WORK AND MATERIALS

A. Pad mounted transformer.

B. Primary conductors and terminations to the transformer.

C. Cable terminations at secondary bushings of transformer.

D. Conduit seal on the transformer end of Contractor -provided conduits to company transformer.

E. Metering circuitry from CT Cabinet to meter.

2.3 CONTRACTOR PROVIDED WORK AND MATERIALS

A. Excavation and backfill for primary and secondary service ductbanks.

B. Conduit ductbank for Utility Company primary conductors to transformer.

C. Transformer pad as directed by Utility Company.

D. Grounding at service entrance and transformer pad.

E. Ductbank from utility pad mounted transformer to service CT Compartment.

F. Secondary conductors from pad mounted transformer to C.T. Compartment.

G. Conduit seals in accordance with Utility Company requirements.

H. Installation of meter base furnished by Power Company.

I. 1-1/4" concealed empty conduit from CT section to utility meter base.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All work shall be in accordance with the Dominion Virginia Power Company "Blue Book" and any supplemental requirements communicated by the power company.

B. Upon completion of duct bank installation, cap ends of conduits to prevent entry of debris. Provide 500 pound stress polyolefin pull lines in all conduits to accommodate the pulling of cables. Prior to Contractor or power company conductor installation, Contractor shall rod all conduits with a mandrel having a diameter of 1/4 inch less than the bore diameter of the conduit, and brush full length with a stiff wire brush.

C. Furnish two (2) copies of as-built drawings showing the actual location and installation of the duct bank to the power company.

D. Backfilling shall be compacted to achieve at least a modified Proctor 95 rating.

END OF SECTION 262713

Blank page

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Wall-switch and exterior occupancy sensors.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. SPD: Surge Protective Device.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Wiring Devices, Inc.
2. Hubbell.
3. Leviton Manufacturing Co., Inc.
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.
b. Hubbell.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
4. For receptacles that are outdoors, provide weather resistant device and a NEMA 3R 'WHILE IN USE' enclosure.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.
b. Hubbell.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Single Pole:

1) Cooper; AH1221.
2) Hubbell; HBL1221.
3) Leviton; 1221-2.
4) Pass & Seymour; CSB20AC1.

b. Two Pole:

1) Cooper; AH1222.
2) Hubbell; HBL1222.
3) Leviton; 1222-2.
4) Pass & Seymour; CSB20AC2.

c. Three Way:

1) Cooper; AH1223.
2) Hubbell; HBL1223.
3) Leviton; 1223-2.
4) Pass & Seymour; CSB20AC3.

d. Four Way:

1) Cooper; AH1224.
2) Hubbell; HBL1224.
3) Leviton; 1224-2.
4) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.
b. Hubbell.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

2.6 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. LED Dimmer Switches: Modular; compatible with dimmer drivers; trim potentiometer to adjust low-end dimming; dimmer-driver combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant**,** thermoplastic with lockable cover.

C. Inmate Accessible Locations.
1. Plate-Securing Screws: Torx head, 1/4x20 center rejection pin type stainless steel screws for all device plates within areas having an I-3 Use Group as designated by Contract Documents.
2. Material for Finished Spaces: Heavy duty, die formed, 10 gauge, cold rolled steel finished in baked white enamel with openings to suit devices. Security wall plates shall be equal to:
   a. Fail-Safe SSB/SPC series
   b. Hubbell SWP series
   c. Kenall WSP/WPP series
3. Back Plate: Heavy duty, 12 gauge steel back plates with locking wings shall be set in place during construction of masonry walls, poured in place concrete and pre-cast assemblies. Steel back plates installed in masonry construction shall be solidly grouted in place.
4. Provide seamless wall plate covers for all devices ganged in a common box

2.8 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.
   2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:

    a. Control circuits.
    b. Enclosed switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

    a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in electronic format suitable for use in coordination software and in PDF format.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in electronic format suitable for use in coordination software and in PDF format.
4. Coordination charts and tables and related data.

1.5 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Bussmann; a division of Cooper Industries.
2. Edison; a brand of Cooper Bussmann; a division of Cooper Industries.
3. Littelfuse, Inc.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
2. Type CC: 600-V, zero- to 30-A rating, 200 kAIC , time delay.
3. Type J: 600-V, zero- to 600-A rating, 200 kAIC.
4. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:
   1. Motor Branch Circuits: Class RK5, time delay.
   2. Large Motor Branch (601-4000 A): Class L, time delay.
   3. Other Branch Circuits: Class RK1, time delay.
   4. Control Transformer Circuits: Class CC, time delay, control transformer duty.
   5. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Non-fusible switches.
3. Shunt trip switches.
4. Molded-case circuit breakers (MCCBs).
5. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

B. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.9 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 All panelboards, switchboards, circuit breakers, dry type transformers and disconnect switches shall be of the same manufacturer.

2.2 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D.

B. Type HD, Heavy Duty, Single Throw, 240 or 480-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 NON-FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.

4. Square D.

B. Type HD, Heavy Duty, Single Throw, 240 or 480-V -V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.4 SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Bussmann; a division of Cooper Industries.
2. Littelfuse, Inc.
3. Mersen USA.

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

E. Accessories:

1. Oiltight key switch for key-to-test function.
2. Oiltight green ON pilot light.
3. Isolated neutral lug; 100 percent rating.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.5 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

F. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

G. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system, specified in Section 260913 "Electrical Power Monitoring and Control."
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Accessory Control Power Voltage: Integrally mounted, self-powered; 120-V ac.

2.6 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:
   1. Reduced-voltage magnetic.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. N.C.: Normally closed.

D. N.O.: Normally open.

E. OCPD: Overcurrent protective device.

F. SCR: Silicon-controlled rectifier.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

   1. Show tabulations of the following:

      a. Each installed unit's type and details.
      b. Factory-installed devices.
      c. Nameplate legends.
      d. Short-circuit current rating of integrated unit.
      e. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. 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.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for setting field-adjustable overload relays.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.10 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 REDUCED-VOLTAGE MAGNETIC CONTROLLERS

A. General Requirements for Reduced-Voltage Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A; closed-transition; adjustable time delay on transition.

B. Reduced-Voltage Magnetic Controllers: Reduced voltage, electrically held.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Eaton Electrical Sector; Eaton Corporation.
b. General Electric Company.
c. Siemens Industry, Inc.
d. Square D.

2. 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 1/2- or 2/3-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.

3. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 24-V ac; obtained from integral CPT, with primary and secondary fuses, with of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

6. Solid-State Overload Relay:

a. Switch or dial selectable for motor running overload protection.
b. Sensors in each phase.
c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

7. N.O., isolated overload alarm contact.
8. External overload reset push button.

C. Combination Reduced-Voltage Magnetic Controller: Factory-assembled combination of reduced-voltage magnetic controller, OCPD, and disconnecting means.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Eaton Electrical Sector; Eaton Corporation.
b. General Electric Company.
c. Siemens Industry, Inc.
d. Square D.

2. MCCB Disconnecting Means:

a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
e. N.C. alarm contact that operates only when MCCB has tripped.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R.
3. Other Wet or Damp Indoor Locations: Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.3 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty.

a. Push Buttons: Shrouded types; momentary as indicated.
b. Pilot Lights: LED types; colors as indicated**;** push to test.
c. Selector Switches: Rotary type.

B. N.C. and N.O. auxiliary contacts.

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

E. Cover gaskets for Type 1 enclosures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

C. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices and smoke control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect Owner before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Set the taps on reduced-voltage autotransformer controllers at 65 percent.

3.7 PROTECTION

END OF SECTION 262913

SECTION 263213 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes packaged engine-generator sets for emergency power supply with the following features:

1. Gas engine.
2. Unit-mounted cooling system.
3. Unit-mounted and remote-mounted control and monitoring.
4. Performance requirements for sensitive loads.
5. Fuel system.
6. Parallel generator sets.
7. Load banks.
8. Outdoor enclosure.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

B. LP: Liquid petroleum.

C. EPS: Emergency power supply.

D. EPSS: Emergency power supply system.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour at 0.5, 0.75 and 1.0 times generator capacity.
5. Include generator efficiency at at 0.5, 0.75 and 1.0 times generator capacity.

6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor, with air supply temperature of 95, 80, 70, and 50 deg F. Provide drawings showing requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to kw rating, efficiency, reactances, and short-circuit current capability.
8. Fuel-Tank Capacity Calculation: Demonstrate the fuel tank contains a minimum of 133 percent of total fuel required for the hours of continuous operation for indicated EPSS class

B. Shop Drawings:

1. Include plans and elevations for engine-generator set and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases. Only required for seismic certified units.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

C. Coordination Study Report: The findings of the Section 260573 Coordination Study Report (CSR) may affect the overcurrent protective devices and fault-current withstand requirements for switchboards, panelboards, generator breakers and transfer switches. Also, the preparation of the CSR is dependent on the manufacturer's data for this equipment. Therefore, until Submittal final Approval is granted for the CSR, these materials shall be considered at best "Approved, pending Approval of the CSR" and not released for order.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
    b. Operating instructions laminated and mounted adjacent to generator location.
    c. Training plan.
    d. Warranty.

1.6 SUBSTITUTIONS

The generator system has been designed to the Basis of Design manufacturer's electrical and physical characteristics. The equipment sizing, spacing, amounts, electrical wiring, ventilation equipment, fuel, and exhaust and other physical and electrical components have all been sized and designed around Caterpillar supplied equipment. Should any other manufacturer's equipment be submitted for use on the project, the equipment provider shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs, which may result. Other generator manufacturers are known to produce equipment capable of meeting the functional requirements of this section but have not been evaluated to confirm they are compatible with the space limitations or any other installation requirements that may differ from the Basis of Design Equipment.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within One year from date of Final Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Kohler Power Systems.
   2. Generac Power Systems, Inc
   3. Caterpillar; Engine Div.
   4. Onan/Cummins Power Generation; Industrial Business Group.
   5. MTU Onsite Energy

B. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. ASME Compliance: Comply with ASME B15.1.

B. Comply with EPA emission standards for reciprocating internal combustion engines (RICE).

C. NFPA Compliance:
   1. Comply with NFPA 37.
   2. Comply with NFPA 70.
   3. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

D. UL Compliance: Comply with UL 2200.

E. Engine Exhaust Emissions: Comply with EPA Tier 2 requirements and applicable state and local government requirements.

F. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

G. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 40 deg C.
2. Altitude: Sea level to 1000 feet.

H. Unusual Service Conditions: Engine-generator equipment and installation are required to operate under the following conditions:

2.3 ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. EPSS Class: Engine-generator set shall be classified as a Class 48 in accordance with NFPA 110.

D. Governor: Adjustable isochronous, with speed sensing.

E. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

F. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

G. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.
9. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.
10. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
11. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
12. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
13. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
14. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
15. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.

    a. Provide permanent magnet excitation for power source to voltage regulator.

16. Start Time: Comply with NFPA 110, Type 10, system requirements.

H. Sound Attenuation:
   1. Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall be 78 dBA or less.

2.4 ENGINE

A. Fuel: Natural Gas

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
1. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
2. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.

5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 A minimum continuous rating.
9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F to 140 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 GASEOUS FUEL SYSTEM

A. Natural-Gas Piping: Comply with requirements in Section 231123 "Facility Natural-Gas Piping."

B. LP-Gas Piping: Comply with requirements in Section 231126 "Facility Liquefied-Petroleum Gas Piping."

C. Gas Train: Comply with NFPA 37.

D. Engine Fuel System:

1. Natural Gas, Vapor-Withdrawal System:

    a. Carburetor.
    b. Secondary Gas Regulators: One for each fuel type, with atmospheric vents piped to building exterior.

c. Fuel-Shutoff Solenoid Valves: NRTL-listed, normally closed, safety shutoff valves; one for each fuel source.
d. Fuel Filters: One for each fuel type.
e. Manual Fuel Shutoff Valves: One for each fuel type.
f. Flexible Fuel Connectors: Minimum one for each fuel connection.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

C. Provide minimum run time control set for 30 minutes with override only by operation of a remote emergency-stop switch.

D. Comply with UL 508A.

E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Panel shall be powered from the engine-generator set battery.

F. Indicating Devices: As required by NFPA 110 for Level 1 system, including the following:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. EPS supplying load indicator.
5. Ammeter and voltmeter phase-selector switches.
6. DC voltmeter (alternator battery charging).
7. Engine-coolant temperature gage.
8. Engine lubricating-oil pressure gage.
9. Running-time meter.
10. Current and Potential Transformers: Instrument accuracy class.

G. Protective Devices and Controls in Local Control Panel: Shutdown devices and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:

1. Start-stop switch.
2. Overcrank shutdown device.
3. Overspeed shutdown device.
4. Coolant high-temperature shutdown device.

5. Coolant low-level shutdown device.
6. Low lube oil pressure shutdown device.
7. Air shutdown damper shutdown device when used.
8. Overcrank alarm.
9. Overspeed alarm.
10. Coolant high-temperature alarm.
11. Coolant low-temperature alarm.
12. Coolant low-level alarm.
13. Low lube oil pressure alarm.
14. Air shutdown damper alarm when used.
15. Lamp test.
16. Contacts for local and remote common alarm.
17. Coolant high-temperature prealarm.
18. Generator-voltage adjusting rheostat.
19. Main fuel tank low-level alarm.

    a. Low fuel level alarm shall be initiated when the level falls below that required for operation for the duration required in "Fuel Tank Capacity" Paragraph in "Diesel Fuel-Oil System" Article.

20. Run-Off-Auto switch.
21. Control switch not in automatic position alarm.
22. Low cranking voltage alarm.
23. Battery-charger malfunction alarm.
24. Battery low-voltage alarm.
25. Battery high-voltage alarm.
26. Generator overcurrent protective device not closed alarm.

H. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

I. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.
2. Coolant low-temperature alarm.
3. High engine temperature prealarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low fuel main tank alarm.
8. Low coolant level alarm.
9. Low cranking voltage alarm.
10. Contacts for local and remote common alarm.

11. Audible-alarm silencing switch.
12. Air shutdown damper when used.
13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.
15. Fuel tank derangement alarm.
16. Fuel tank high-level shutdown of fuel supply alarm.
17. Lamp test.
18. Low cranking voltage alarm.
19. Generator overcurrent protective device not closed.

J. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

K. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

L. Connection to Datalink: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication. Provide connections for datalink transmission of indications to remote data terminals via ModBus.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.

1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Circuit Breaker: Molded-case, type; 100 percent rated; complying with UL 489.
1. All breakers feeding panelboards on the life safety, legally required and optional standby systems shall be LSI (long time, short time and instantaneous) mission critical breakers. Upsize the breaker frame size as required.
2. AIC rating shall match the breaker suppling the ATS from the normal utility supply
3. Tripping Characteristic: Designed specifically for generator protection.
4. Trip Rating: Matched to generator output rating.
5. Mounting: Adjacent to or integrated with control and monitoring panel.

C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.

2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

D. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.
1. Trip generator protective device on ground fault.

E. If output circuit breaker(s) and/or generator controls are located more than 6'-6" above the finished grade and/or are not readily accessible and with clearances as required by the NEC, provide all necessary work and materials including but not limited to ramps, stairs, and platforms required to achieve compliance with the conditions above. All provisions shall conform to OSHA, state and local safety requirements including but not limited to handrails, markings, signage, and access barriers.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required..

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Dripproof.

G. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.

1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Maintain voltage within 15 percent on one step, full load.
3. Provide anti-hunt provision to stabilize voltage.

H. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.9 LOAD BANK (When indicated on the drawings)

A. Description: Permanent, outdoor, weatherproof, radiator mounted remote-controlled, forced-air-cooled, resistive unit capable of providing a balanced three-phase, delta-connected load to generator set at 100 percent rated-system capacity, at 80 percent power factor, lagging. Unit shall be capable of selective control of load in 25 percent steps and with minimum step changes of approximately 5 and 10 percent available.

B. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and stainless-steel supports. Elements shall be double insulated and designed for repetitive on-off cycling. Elements shall be mounted in removable aluminized-steel heater cases. Galvanized steel is prohibited. Element's maximum resistance shall be between 100 and 105 percent of rated resistance.

C. Load-Bank Heat Dissipation: Integral fan with totally enclosed motor shall provide uniform cooling airflow through load elements. Airflow and coil operating current shall be such that, at maximum load, with ambient temperature at the upper end of specified range, load-bank elements operate at not more than 50 percent of maximum continuous temperature rating of resistance elements.

D. Load-Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors shall be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.

E. Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.

F. Load-Bank Enclosures: NEMA 250, Type 3R, aluminized steel complying with NEMA ICS 6. Louvers at cooling-air intake and discharge openings shall prevent entry of rain and snow. Openings for airflow shall be screened with 1/2-inch- square, galvanized-steel mesh. Load bank shall include automatic shutters at air intake and discharge. Components other than resistive elements shall receive exterior epoxy coating with compatible primer.

G. Protective Devices: Power input circuits to load banks shall be fused, and fuses shall be selected to coordinate with generator circuit breaker. Fuse blocks shall be located in contactor enclosure. Cooling airflow and overtemperature sensors shall automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors shall disconnect load power, control, and heater circuits. Fan motor shall be separately protected by overload and short-circuit devices. Short-circuit devices shall be noninterchangeable fuses with 200,000 A interrupting capacity.

2.10 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, sound-attenuating, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
3. Ventilation: Provide temperature-controlled exhaust fan interlocked to prevent operation when engine is running.

C. Enclosure Heater: Electric, factory to comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

D. Provide unit battery powered emergency lighting fixture within the weatherproof enclosure interior

2.11 MOTORS

A. Description: NEMA MG 1, Design B, medium induction random-wound, squirrel cage motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

E. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

F. Temperature Rise: Match insulation rating.

G. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

H. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

I. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.

2.12 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient

stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

B. Comply with requirements in Section 232116 Hydronic Piping Specialties" for vibration isolation and flexible connectors materials for steel piping.

C. Comply with requirements in Section 233113 "Metal Ducts" for vibration isolation and flexible connector materials for exhaust shroud and ductwork.

D. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.13 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.14 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Test generator, exciter, and voltage regulator as a unit.
3. Full load run.
4. Maximum power.
5. Voltage regulation.
6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdown.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than ten working days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

3.3 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations."
2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
3. Provide the pad to include the overall footprint of the generator with stair and fuel tank plus 12" on all sides. Coordination pad opening with the manufacturer. Refer to the detail on the structural drawing for pad construction.

C. Install packaged engine-generator to provide access, without removing connections or accessories, for periodic maintenance.

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine-generator to allow service and maintenance.

C. Connect engine exhaust pipe to engine with flexible connector.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90 degree bend in flexible conduit routed to the generator set from a stationary element.

F. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.5 IDENTIFICATION

A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs as specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.

a. Visual and Mechanical Inspection

1) Compare equipment nameplate data with drawings and specifications.
2) Inspect physical and mechanical condition.
3) Inspect anchorage, alignment, and grounding.
4) Verify the unit is clean.

b. Electrical and Mechanical Tests

1) Perform insulation-resistance tests in accordance with IEEE 43.

a) Machines larger than 200 horsepower. Test duration shall be 10 minutes. Calculate polarization index.
b) Machines 200 horsepower or less. Test duration shall be one minute. Calculate the dielectric-absorption ratio.

2) Test protective relay devices.

3) Verify phase rotation, phasing, and synchronized operation as required by the application.
4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
5) Conduct performance test in accordance with NFPA 110.
6) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test. Complete the form attached in part 4. A digital copy (PDF or excel) is available from the Architect by request. Include the completed test form in the O& M manual.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
c. Verify acceptance of charge for each element of the battery after discharge.
d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust Emissions Test: Comply with applicable government test criteria.
7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.
8. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
9. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations 25 feet from edge of the generator enclosure , and compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

K. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

L. Upon completion of testing, provide a full tank of fuel within all provided fuel tanks.

3.7 WARRANTY

A. Warranty Period: Provide a warranty to repair or replace for five years from date of Final Acceptance.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

C. Short Circuit Study Report: The findings of the Section 260572 Overcurrent Protective Device Short Circuit Study may affect the overcurrent protective devices and fault-current withstand requirements for switchboards, panelboards, and transfer switches. Also, the preparation of the study is dependent upon the manufacturer's data for this equipment. Therefore until Submittal final Approval is granted for the study, these materials shall be considered at best "Approved, pending Approval of the study" and not released for order.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 99.

G. Comply with NFPA 110.

H. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Automatic Transfer Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Caterpillar.
    b. GE Zenith Controls.
    c. Kohler Power Systems.
    d. Onan/Cummins Power Generation.
    e. Russelectric, Inc.

2.2 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

H. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

2.3 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

B. Identify components according to Section 260553 "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
    f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.

g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes lightning protection for structures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For air terminals and mounting accessories.

1. Layout of the lightning protection system, along with details of the components to be used in the installation.
2. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer. Include data on listing or certification by UL.

B. Certification, signed by Contractor, that roof adhesive is approved by manufacturer of roofing material.

C. Field quality-control reports.

D. Comply with recommendations in NFPA 780, Annex D, "Inspection and Maintenance of Lightning Protection Systems," for maintenance of the lightning protection system.

E. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features, including the following:

1. Ground rods.
2. Ground loop conductor.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Certified by UL, trained and approved for installation of units required for this Project.

B. System Certificate:

1. UL Master Label.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

1.6 COORDINATION

A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

C. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.

PART 2 - PRODUCTS

2.1 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Comply with UL 96 and NFPA 780.

B. Roof-Mounted Air Terminals: NFPA 780, Class I, copper unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Advanced Lightning Technology, LTD.
b. East Coast Lightning Equipment Inc.
c. ERICO International Corporation.

2. Air Terminals More than 24 Inches Long: With brace attached to the terminal at not less than half the height of the terminal.
3. Single-Membrane, Roof-Mounted Air Terminals: Designed specifically for single-membrane roof system materials. Comply with requirements in roofing Sections.

C. Main and Bonding Conductors: Copper.

D. Ground Loop Conductor: The same size and type as the main conductor except tinned.

E. Ground Rods: Copper-clad steel**,** sectional type; 3/4 inch in diameter by 10 feet long.

F. Heavy-Duty, Stack-Mounted, Lightning Protection Components: Solid copper.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends.

C. Conceal the following conductors:

1. System conductors.
2. Down conductors.
3. Interior conductors.
4. Conductors within normal view of exterior locations at grade within 200 feet of building.

D. Cable Connections: Use crimped or bolted connections for all conductor splices and connections between conductors and other components. Use exothermic-welded connections in underground portions of the system.

E. Cable Connections: Use exothermic-welded connections for all conductor splices and connections between conductors and other components.

1. Exception: In single-ply membrane roofing, exothermic-welded connections may be used only below the roof level.

F. Air Terminals on Single-Ply Membrane Roofing: Comply with roofing membrane and adhesive manufacturer's written instructions.

G. Bond extremities of vertical metal bodies exceeding 60 feet in length to lightning protection components.

H. Ground Loop: Install ground-level, potential equalization conductor and extend around the perimeter of structure.

1. Bury ground ring not less than 24 inches from building foundation.
2. Bond ground terminals to the ground loop.
3. Bond grounded building systems to the ground loop conductor within 12 feet of grade level.

I. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot intervals.

3.2 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.

B. UL Inspection: Meet requirements to obtain a UL Master Label for system.

END OF SECTION 264113

SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

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 field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.3 DEFINITIONS

A. Inominal: 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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE SUPPRESSOR

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Advanced Protection Technologies Inc. (APT).
2. Current Technology Inc.
3. LEA International.
4. Liebert; a brand of Emerson Electric Co.

B. SPDs: Comply with UL 1449, Type 1.

C. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1.

1. SPDs with the following features and accessories:

a. Integral disconnect switch.
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts rated at 5 A and 250-V, one normally open and one normally closed, for remote monitoring of protection status.
e. Surge counter.

D. Comply with UL 1283.

E. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

F. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1200 V for 480Y/277 V.
3. Line to Line: 2000 V for 480Y/277 V.

G. SCCR: Equal or exceed 200 kA.

H. Inominal Rating: 20 kA.

2.3 PANEL SUPPRESSORS

A. Retain this article for SPDs other than those installed at the service entrance. SPD described in this article is required by NFPA 70 to be installed with OCPD. The type and size of OCPD depends on the UL listing requirements. See "SPD Types" Article in the Evaluations.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Advanced Protection Technologies Inc. (APT).
2. Current Technology Inc.
3. Leviton Manufacturing Co., Inc.
4. Liebert; a brand of Emerson Electric Co.

C. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in each mode.

E. Comply with UL 1283.

F. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 700 V for 208Y/120 V.
3. Neutral to Ground: 700 V for 208Y/120 V.
4. Line to Line: 1200 V for 208Y/120 V

G. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.
4. Line to Line: 1200 V.

H. SCCR: Equal or exceed 100 kA.

I. Inominal Rating: 20 kA.

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. 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 splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. 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.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 264313

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Exit Signs
3. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, occupancy sensors, and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.

4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
7. Confirmation of compliance with Design Lighting Consortium (DLC) or ENERGY STAR product requirements.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of luminaire.

C. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Exit signs: Provide 5 additional exit signs (single face or double face, as needed) including 100' of conduit, boxes, wire, associated accessories and installation for each. Exit signs shall be installed as directed by the Architect, Owner, or Authority Having Jurisdiction (AHJ). Any unused additional exit signs shall be turned over to the Owner in their original boxes.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. All interior LED lighting fixtures shall be compliant with current product requirements of Design Lighting Consortium (DLC) or ENERGY STAR program.

D. Recessed Fixtures: Comply with NEMA LE 4.

E. Bulb shape complying with ANSI C79.1.

F. Lamp base complying with ANSI C81.61 or IEC 60061-1.

G. CRI of minimum 80. CCT of 3000 K.

H. Rated lamp life of 50,000 hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output.

J. Internal driver:
1. Minimum efficiency: 85% at full load.
2. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.).
3. Input Voltage: 120 - 277V (±10%) at 60 Hz.
4. Integral short circuit, open circuit, and overload protection.
5. Power Factor: ≥ 0.95.
6. Total Harmonic Distortion: ≤ 20%.
7. Comply with FCC 47 CFR Part 15.

K. LED Modules:
1. Comply with IES LM-79 and LM-80 requirements.
2. Minimum CRI 80 and color temperature 4200˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
3. Minimum Rated Life: 50,000 hours per IES L70.
4. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

L. Nominal Operating Voltage: 120 V ac or 277 V ac.

M. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

N. Housings:

1. Extruded-aluminum housing and heat sink.
2. Powder-coat finish.

2.2 Pendant Bowls

A. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.

B. Minimum 3000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. With integral mounting provisions.

2.3 DOWNLIGHT

A. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.

B. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Universal mounting bracket.

D. Integral junction box with conduit fittings.

2.4 LINEAR INDUSTRIAL

A. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.

B. Minimum 3,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

2.5 PARKING GARAGE

A. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.

B. Minimum 3,000 lumens. Minimum allowable efficacy of 75 lumens per watt.

C. Low-profile housing and heat sink.

D. Fully gasketed and sealed. IP 65 rated.

E. Stainless-steel latches.

F. Integral pressure equalizer.

2.6 RECESSED LINEAR

A. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.

B. Minimum 1,500 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.7 STRIP LIGHT

A. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.8 SURFACE MOUNT, LINEAR

A. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.9 SURFACE MOUNT, NONLINEAR

A. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.10 SUSPENDED, LINEAR

A. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

2.11 SUSPENDED, NONLINEAR

A. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.12 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.13 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally when secured in operating position.

C. Diffusers and Globes:

1. Tempered Fresnel glass, prismatic glass, diffuse glass, clear glass, prismatic acrylic, or clear, UV-stabilized acrylic.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. Powder-coat finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.14 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.15 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch diameter aircraft cable supports adjustable to 120 inches in length.
2. Ceiling mount with pendant mount with 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

SECTION 265613 - LIGHTING POLES AND STANDARDS

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. Poles and accessories for support of luminaires.

1.3 DEFINITIONS

A. EPA: Equivalent projected area.

B. Luminaire: Complete lighting fixture.

C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

D. Standard: See "Pole."

1.4 ACTION SUBMITTALS

A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device, arranged as indicated.

1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
2. Include finishes for lighting poles and luminaire-supporting devices.
3. Anchor bolts.
4. Manufactured pole foundations.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of poles and pole accessories.

4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
6. Method and procedure of pole installation. Include manufacturer's written installations.

1.5 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

B. Qualification Data: For Installer.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample Warranty: Manufacturer's standard warranty.

F. Soil test reports

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For poles to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include pole inspection and repair procedures.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Pole repair materials.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of poles that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

1. Warranty Period: Five years from date of Substantial Completion.
2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design pole foundation.

B. Structural Characteristics: Comply with AASHTO LTS-6-M.

C. Dead Load: Weight of luminaire and its horizontal and vertical supports, and supporting structure, applied according to AASHTO LTS-6-M.

D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.

1. Basic wind speed for calculating wind load for poles 50 feet high or less is 90 mph.

a. Wind Importance Factor: 1.0.
b. Minimum Design Life: 25 years.
c. Velocity Conversion Factor: 1.0.

E. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.

F. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 STEEL POLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products shall be as indicated on the drawings.

B. Source Limitations: Obtain poles from single manufacturer or producer.

C. Poles: Comply with ASTM A 500/A 500M, Grade B carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.

1. Shape: Round, tapered.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

D. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with galvanized-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

E. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

F. Fasteners: Galvanized steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

G. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

H. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

I. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces according to SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Powder Coat: Comply with AAMA 2604.

    a. Electrostatic-applied powder coating; single application and cured to a minimum 2.5- to 3.5-mils dry film thickness. Coat interior and exterior of pole for equal corrosion protection.
    b. Color: As selected by Architect from manufacturer's full range.

2.3 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

2.4 MOUNTING HARDWARE

A. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi.

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.

B. Nuts: ASTM A 563, Grade A, Heavy-Hex

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
2. Four nuts provided per anchor bolt, shipped with nuts pre-assembled to the anchor bolts.

C. Washers: ASTM F 436, Type 1.

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
2. Two washers provided per anchor bolt.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

C. Examine roughing-in for foundation and conduit to verify actual locations of installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Anchor Bolts: Install plumb using manufacturer-supplied plywood template, uniformly spaced.

3.3 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.

1. Fire Hydrants and Water Piping: 60 inches.
2. Water, Gas, Electric, Communications, and Sewer Lines: 10 feet.
3. Trees: 15 feet from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.
4. Use a short piece of 1/2 -inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch-wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch below top of concrete slab.

F. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.4 CORROSION PREVENTION

A. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.5 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Inspect poles for nicks, mars, dents, scratches, and other damage.
2. System function tests.

END OF SECTION 265613

SECTION 265619 – LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.

3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

    a. Manufacturer's Certified Data: Photometric data certified by manufacturers laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

6. Wiring diagrams for power, control, and signal wiring.
7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
8. Confirmation of compliance with Design Lighting Consortium (DLC) or ENERGY STAR product requirements.

B. Product Schedule: For luminaires and lamps, Refer to light fixture on contract drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Product Certificates: For each type of the following:

1. Luminaire.

C. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Source quality-control reports.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Provide luminaires from a single manufacturer for each luminaire type.

B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

C. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.
b. Faulty operation of luminaires and accessories.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 1598 and listed for wet location.

C. CRI of 80. CCT of 3000 K.

D. L70 lamp life of 50,000 hours.

E. Lamps dimmable from 100 percent to 0 percent of maximum light output.

F. Internal driver.

G. Nominal Operating Voltage: 277 V ac.

H. In-line Fusing: On the primary for each luminaire.

I. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

J. Source Limitations: Obtain luminaires from single source from a single manufacturer.

K. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 LUMINAIRE TYPES

A. Area and Site:

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled on the drawings.
2. Luminaire Shape: Hexagonal.

3. Mounting: Pole.
4. Luminaire-Mounting Height: Refer to contract drawings.
5. Distribution: Refer to contract drawings.
6. Diffusers and Globes: Tempered Fresnel glass, Prismatic glass, Diffuse glass, Clear glass, Prismatic acrylic, Clear, UV-stabilized acrylic or Clear polycarbonate.
7. Housings:

   a. Extruded-aluminum housing and heat sink.
   b. Powder-coat finish.

2.3 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Epoxy-coated steel. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage and coating.
c. CCT and CRI for all luminaires.

2.4 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

2.5 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, and canopy ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Fasten luminaire to structural support.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

F. Wiring Method: Install cables in raceways. Conceal raceways and cables.

G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

H. Coordinate layout and installation of luminaires with other construction.

I. Adjust luminaires that require field adjustment or aiming.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. Install on concrete base with top flush with surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.4 CORROSION PREVENTION

A. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
   a. IES LM-64.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265619

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Communications equipment coordination and installation.
2. Sleeves for pathways and cables.
3. Sleeve seals.
4. Grout.
5. Common communications installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 270500

SECTION 270528 - PATHWAYS FOR AUDIOVISUAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections and Division 27 General Requirements Section apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Pathway systems for conveyance of audiovisual systems cable.

B. Related Requirements:
   1. Division 26 Sections for pathway products used for NEC Class-A electrical work
   2. Section 270526 Grounding and Bonding
   3. Section 270550 Firestopping

1.03 REFERENCES

A. Abbreviations:
   1. ETL: Electrical Testing Laboratory. An NRTL
   2. NFPA: National Fire Protection Association
   3. NEC: National Electric Code
   4. NECA: National Electrical Contractors Association
   5. NEMA: National Electrical Manufacturers Association
   6. UL: Underwriter's Laboratory

B. Standards:
   1. NFPA 72: National Fire Alarm and Signally Code.
   2. NEC: 2011, or the most current Edition.
   3. TIA/EIA-569-B, or most current version, Commercial Building Standard for TeleAudioVisual Pathways and Spaces.
   4. AVIXA

1.04 PRE-INSTALLATION MEETINGS

A. Coordinate and conduct face-to-face meetings at the Project site with each contractor, sub-contractor, and vendor providing one or more products as work of this Division. Include the Owner in these meetings if the Owner is supplying or installing any product that will utilize the pathway system.

B. Review the pathway requirements for each system in detail to ensure that the pathways, as they are to be installed, will fully satisfy the needs of each system, each device and cabling, including cable separation requirements.

1.05 SUBMITTALS

A. General:
   1. Comply with Section 270503 Submittals.

B. Coordination Certifications:
   1. Coordination Certification: Letter of Coordination Certification from each entity installing cable on the Project that certifies the pathway system being installed:
      a. Includes adequate cross-sectional area to accommodate cables that are to be installed;
      b. Allows for adequate separation from probable sources of ingress and egress interference, including other cables and cables that may share the same pathway segment;
      c. Follows a physical path that ensures cables shall not exceed maximum installed length limitations.
   2. Shop Drawings:
      a. Coordinated floor plan drawings depicting the size(s), locations, and dimensions of the following:
         1) Primary pathways.
         2) Conduit sleeves (e.g., thru-the-wall, thru-the-floor, and thru-the-bulkhead).
         3) Roof penetrations.
      b. Cross-sectional drawings: of spaces depicting the coordinated placement of primary pathways jointly with HVAC ductwork, fire-suppression, plumbing piping and major electrical work. Drawings shall identify elevation and clearances that will be maintained around pathway components. Preparation of these drawings shall require collaboration with corresponding trades.
         1) Common cross-sectional pathway shop drawings include:
            a) Corridor ceiling cavities.
            b) Mechanical rooms through which pathways must pass.
            c) Audiovisual rooms.
      c. Conduit Interconnect Diagrams: for each totally-enclosed pathway system.

C. Samples:
   1. One (1) of each model and size of floor box cover to be furnished.

D. Closeout Submittals:
   1. Accurate up-to-date as-built versions of shop drawings.

1.06 QUALITY ASSURANCE

A. Comply with Section 270002 Quality Assurance.

B. Supplied components shall be safety tested and listed by one or more United States NRTL. Presently recognized laboratories include: Underwriters Laboratories (UL) and Electrical Testing Labs (ETL).

C. Installation personnel shall be manufacturer trained on the anchoring system being utilized.

PART 2 – PRODUCTS

2.01 SYSTEM DESCRIPTION

A. General:

1. Each Audiovisual pathway system shall consist of products to support, protect, enclose, manage and secure the cables that are part of the communication system they serve.
2. Pathway systems shall be supplied and installed to meet the unique requirements of individual Audiovisual systems.
3. Separate pathway systems shall be provided for individual communication systems. Individual communication systems shall have unique and dedicated conveyances. Cables from individual communication systems shall be run in separate conveyances (e.g., data system cables shall be run in separate conveyances from sound system cables).
4. Separate pathway conveyances shall be provided for cables that carry incompatible signal types (e.g., analog microphone level and speaker level cables shall be run in separate conveyances).
5. Pathway systems shall include penetrations through walls, floors, ceilings, roofs, bulkheads and other physical barriers that are necessary to route cable between adjacent spaces.
6. Pathway penetrations shall be prepped, installed, sealed and fire stopped in a code-compliant manner.
7. Pathways shall be assembled from components that are listed by a recognized safety testing laboratory.
8. Pathway systems shall be provided with sufficient support to carry the weight of the system, plus a full capacity of cables, with a safety factor of greater than or equal to 5. In addition, each individual above-the-floor vertical hanging support shall feature an installed static weight support capacity of not less than 200 lbs. (e.g., hanging all-thread, multi-anchor mounting flange and support cable).
9. Pathway systems shall include matching cover plates over junction and pull boxes.

2.02 RACEWAY

A. Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hubbell-Raco (Raco).
   b. Allied Tube & Conduit / Atkore (Allied).
   c. Republic Conduit (Republic).
   d. CalConduit (CalConduit).

B. Wireway:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hubbell-Raco.
   b. Allied Electrical.
   c. Hoffman.
   d. Cooper.
   e. Square-D.

2.03 DISCRETE CABLE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into work include:

1. Erico CableCat™ Series.
2. Panduit J-Pro™ Series.
3. Cooper/B-Line BCH Series.

2.04 FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hubbell-Raco (Raco).
   2. Allied Tube & Conduit / Atkore (Allied).
   3. Republic Conduit (Republic).
   4. CalConduit (CalConduit).

B. Conduit Sealing Bushings:
   1. Factory-fabricated watertight conduit sealing bushing assemblies.
   2. Suitable for sealing around conduit or tubing passing through concrete floors and walls.
   3. Constructed of steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

C. Insulating Bushings:
   1. Designed to protect cables from damage caused by sharp edges on the exposed end(s) of conduit and associated fittings, fully insulating the exposed end.
   2. Rated for use in the environment where the product is installed.
   3. Sized to match the conduit or conduit fitting to which it is applied.
   4. Soft radius non-conductive front edge to prevent damage to cables passing through the bushing.
   5. Sized to hold firmly to the conduit or fitting to which it attaches with sufficient strength that the bushing cannot and will not come free during the installation of cable.
   6. Non-conductive version:
      a. Threaded version: Provide threaded version for use on the threaded end of conduits or fittings.
      b. Press-on version: Provide press-on version for use on non-threaded end of conduits and conduit fittings.
      c. Internal diameter of one end equal to or slightly less than the internal diameter of the conduit or fitting to which it attaches. The opposite end sized to match the conduit or fitting to which it is applied.
      d. Designed for installation before any cable is installed.
   7. Conductive version:
      a. Conductive metal frame.
      b. Integral grounding lug.
      c. Separate non-conductive insulator to protect cable.
      d. Designed for installation before any cable is installed.

2.05 BOXES

A. Standard Wall and Ceiling Device Boxes:
   1. General:
      a. Stamped steel, code-compliant gauge, zinc galvanized.

b. Depths of 2-1/2 inches plus mud rings, minimum.
c. Corrosion protection suitable for the atmosphere in which they are installed.
d. Non-modular sheet-steel construction.
e. Conduit knockouts of the size, quantity and locations required.
f. Threaded device-mounting screw holes.
g. Rated for installation in the space where the box is installed.
h. Equip boxes with code compliant accessory Class-1 and Class-2 service partitions when boxes are used in multi-service applications.
i. 3R (at minimum).

B. Specialty Wall/Ceiling Boxes:

1. Manufacturers: Subject to compliance with requirements, provide the Basis of Design product listed, or Designer approved comparable product from one of the following manufacturers:
   a. FSR, Inc.
   b. Legrand/Wiremold.
   c. Hubbell Inc.
   d. Chief
   e. Arlington

C. Floor Boxes:

1. Manufacturers: Subject to compliance with requirements, provide the Basis of Design product listed, or Designer approved comparable product from one of the following manufacturers:
   a. FSR, Inc.
   b. Legrand/Wiremold.
   c. Hubbell Inc.

2.06 ACCESSORIES

A. Pull Strings:

1. Construction: nylon.
2. Designed and rated by the manufacturer for use as a pull-rope.

B. Supports:

1. General:
   a. Supports, support hardware, and fasteners shall be manufacturer protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic.
   b. Products used outdoors shall be hot-dip galvanized.
2. Material Types:
   a. Raceway Supports:
      1) Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
   b. Fasteners:
      1) Types, materials, and construction features as follows:
      a) Expansion anchors: Carbon steel wedge or sleeve type.
      b) Toggle bolts: All-steel springhead type.

c) Powder-driven threaded studs anchors: Heat-treated steel, designed specifically for the intended service.
d) Solid concrete anchors: Drop-in zinc plated steel tubular expansion shield with solid, cone-shaped expander plug.

c. Cable supports for vertical conduit:
1) Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits.
2) Provide with plugs with the number and size of conductor gripping holes as required to suit each individual application.
3) Body construction: Malleable-iron casting with hot-dip galvanized finish.

d. Threaded Rod Stock (All-Thread Rod):
1) Available in 1/4-inch, 3/8-inch, 1/2-inch, and 5/8-inch sizes.

e. Slotted Metal Angle and U-channel Systems:
1) 16-gauge steel U-shaped channel;
2) Available in a variety of sizes including: 1-5/8 inches square, 1-1/4 inches square and 13/16 inch square.
3) Available with pre-punched and un-punched versions.
4) Available with holes on top or sides of channel.
5) Available with a wide-variety of fittings for field construction of structural support assemblies.

C. Bushing, Knockout Closures and Locknuts:

1. Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

PART 3 – EXECUTION

3.01 COORDINATION

A. Review and coordinate the size requirements of pathways with the suppliers and installers of cabling and devices. Pathway segments shall accommodate the quantity and type of cables that will be installed. Upsize pathway segments from any default and minimum size(s) identified so as to accommodate the cables that will be installed, including any future expansion capacities, as identified in the Contract Documents.

B. Review the specific routes and composite length of planned pathway routes with parties responsible for supplying or installing cables as distance limitations will apply differently for different cables and applications.

C. Coordinate the location and routing of pathways with work of this Division, the work of other trades, the work of the Owner, and existing site conditions (where applicable) to ensure adequate headroom, post installation access to and working clearances around the pathways. Review and verify HVAC, Fire Suppression, Electrical Power, Lighting and other Drawings for design coordination. Provide routes accordingly.

D. Proactively participate with other trades in the creation of coordination drawings that depict primary and major secondary pathways. Emphasis shall be placed on ensuring that pathways are

accessible for initial cable installation and readily accessible for reuse in accommodating future cable moves, additions and changes.

`E. Coordinate the colors and types of surface raceway with the color of surface raceway provided as work of both Division 26 and Division 28. Colors of raceways shall match, except where expressly reviewed and approved by the Architect/Designer.

F. Ensure that pathways, as installed, are adequately sized for the cables to be installed and any future expansion capacities as identified in the Contract Documents.

3.02 BOX USAGE

A. Boxes:

1. Boxes shall be used at device and equipment locations. Raceway shall terminate into an approved box, except where indicated.
2. Standard wall and ceiling boxes shall be used in walls and ceilings except where specialty boxes are indicated.
3. Boxes designed expressly for use within floors shall be used within floors. The type of box used shall be appropriate for the floor construction.
4. The size and type of boxes used shall accommodate the quantity and type of cable, raceway and devices the box must accommodate.
5. Junction boxes and pull boxes shall be sized to comply with the NEC, but not less than the sizes indicated in the Contract Documents.
6. Custom size and special-order boxes shall be provided where custom sizes and special-order boxes are required to meet the project requirements.

3.03 INSTALLATION

A. General:

1. Install in accordance with local codes. Adhere to clearance and fire protection regulations.
2. Install above-grade pathways parallel to and perpendicular to building elements.
3. Install pathways plumb and level except where changes in elevation are specifically necessary for constructability.
4. Document the exact routing of concealed pathways on as-built drawings

B. Bonding and Grounding:

1. Conductive components of the pathway systems shall be bonded to ground in accordance with the NFPA and the NEC.

C. Conduit bends:

1. Bends shall be made so that the conduit will not be flattened or kinked and so that the internal diameter of the conduit is not reduced.

D. Pull Boxes:

1. Install each pull box per NEC cable pull requirements and as indicated on the Drawings.

E. Pull Stings:

1. Install a usable pull string in every pathway prior to the installation of cables. The string shall be installed after pathway installation and prior to such time as the cable installer desires to install cable within the pathway. The string shall be used as an aid to the installation of cables.
2. Install a replacement pull string in each pathway as part of the cable installation process to facilitate installation of additional cable(s). Tie the pull-string off and tag for "Future Use."

F. Discrete Cable Supports:

1. Install supports in areas that will be readily accessible after installation (e.g., above accessible suspended ceilings; up within the building structure in unfinished areas).

G. Device Boxes:

1. New-work and old-work device boxes shall be installed flush with or slightly recessed below the finished surface. Do not recess boxes more than is permitted by code, nor more than .078 inches (2mm). Old-work boxes require advanced craftsmanship and construction techniques to achieve specification compliance for Audiovisual Work.

H. Sleeves and Penetrations:

1. Sleeves through poured-in-place concrete surfaces shall be set in place prior to the concrete pour and protected from concrete ingress.
2. Sleeves through floors shall be installed to prevent the passage of water between the sleeve and the floor.
3. Install cable-protecting insulating bushings on each end of each sleeve.
4. Extend through-the-wall sleeves a minimum of 2 inches beyond the wall surface. Extend the sleeve a greater distance where necessary to permit proper installation of cable-protecting bushings and any associated cable waterfalls.
5. Extend through-the-floor sleeves to a consistent elevation of 4 inches to 6 inches above finished floors, except where otherwise noted on the Drawings.
6. Fill the voids between sleeve and building surface with approved fire stop material sufficient to maintain the fire-rating of the building surface.

I. Conduit Stubs:

1. Install cable-protecting insulating bushings on each conduit stub.

J. Water Proofing:

1. Protect raceways from moisture infiltration in areas where moisture penetration is probable (e.g., outdoors, natatoriums, wash bays).
2. Provide watertight fittings where one or more cables exit the pathway in areas where moisture penetration is probable.
3. Seal below-grade conduit joints to prevent moisture infiltration.
4. Seal joints of conduits in high-moisture areas to prevent moisture infiltration.
5. Pressure or vacuum test below-grade conduits before and after concealing the conduits to ensure resistance to moisture ingress.

K. Repair and Patching:

1. Holes and other penetrations into building surfaces or structure that are created to facilitate pathway installation but that are not ultimately used shall be filled, repaired, and restored to their original strength, appearance and integrity.
2. Damage to building or property that occurs during the course of pathway installation shall be repaired and restored to its original condition prior to damage.

L. Cover Plates

1. Provide cover plates over the openings of junction boxes, pull boxes and cast boxes.

3.04 FIRESTOPPING

A. Comply with Section 270550 Firestopping

END OF SECTION 27 0528

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Telecommunications service entrance pathways.
5. Grounding.

B. Related Sections:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for conduits that serve communication cabling.
2. Division 26 Section "Raceways and Boxes for Electrical Systems" for conduits that serve communication cabling.
3. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. LAN: Local area network.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. For each data room, security electronics room, telephone room or similar communications equipment room. provide plans detailing the layout of the room utilizing the dimensions of the actual equipment to be supplied. Provide elevations, sections, details, and

attachments to supplement the plans as required to ensure the installation is coordinated with the work of other trades.

2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
4. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A. Requirements of this standard include but are not limited to minimum 1/8" per foot slope for drainage of underground communication ductbank conduits; coordinate with Division 26 conduit installation.

C. Grounding: Comply with ANSI-J-STD-607-A.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.7 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Lacing bars, spools, J-hooks, and D-rings.
4. Straps and other devices.

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Cable Management Solutions, Inc.
b. Cablofil Inc.
c. Cooper B-Line, Inc.
d. Cope - Tyco/Allied Tube & Conduit.
e. GS Metals Corp.

2. Cable Tray Materials: Basket type metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick or hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch (0.055 mm) thick.

D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ADC.
2. Aim Electronics; a brand of Emerson Electric Co.
3. AMP; a Tyco International Ltd. company.
4. Cooper B-Line, Inc.
5. Hubbell Premise Wiring.
6. KRONE Incorporated.
7. Leviton Voice & Data Division.
8. Middle Atlantic Products, Inc.
9. Nordex/CDT; a subsidiary of Cable Design Technologies.
10. Ortronics, Inc.
11. Panduit Corp.
12. Siemon Co. (The).

B. General Frame Requirements:

1. Distribution Frames: Freestanding four post, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks:

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
2. Baked-polyester powder coat finish.
3. Two-post relay racks shall be 45 U in height, three (3) inches deep and include 19"EIA Universal Rail Spacing, 1-3/4"height U spaces, #12-24 threaded mounting holes, Marked and numbered U spaces black in color. Each rack shall include:

D. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Rack mounting.

2. Six, 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
3. LED indicator lights for power and protection status.
4. LED indicator lights for reverse polarity and open outlet ground.
5. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
6. Cord connected with 15-foot (4.5-m) line cord.
7. Rocker-type on-off switch, illuminated when in on position.
8. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
9. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

2.5 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Telecommunications Main Grounding Busbar (TMGB and TMG):

1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick as detailed on drawing E4.1.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

2.6 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. At least one of the 4" conduits shall have two 3X3 MaxCell MXD detectable installed. Each MaxCell is to have different color ID markings. MaxCell must be installed to manufacturer's instruction including the use of ball bearing swivels and the MaxWell's pull tapes must remain free floating throughout installation. (Plastic flexible innerduct not allowed).

C. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article and Div 26 - Underground Ducts And Raceways For Electrical Systems, except Hand holes are to be open bottom (on top of 4" of rock), with a minimum size of 30" X 48", cover labeled "Communications". Cover to have pull slot with center pin.

D. Conduit used for network cabling shall not be longer than 100 feet between pull points or contain more than (2) 90-degree bends between pull points. Bends beyond 100-degrees shall be replaced with a pull box. Flexible metal conduit shall not be used for network cabling.

E. Conduits shall be clean, free of debris and water, unobstructed. Reamed and fitted with bushings, bonded to ground as required by code, capped for protection and equipped with a plastic or nylon pull line rated at 200lb. Seal conduits with pliable / non-hardening duct seal to keep out rodents and moisture.

3.2 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

C. Firestopping around the outside of the conduits shall be elastomeric (permanent). Firestopping inside the conduit shall be pliable putty (removable). Conduits must be available for re-entry for future cabling without "digging out" hardened fire stop.

3.3 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. Labels shall be preprinted or computer-printed type.

3.5 INSTALLATION

A. TR - Telecommunication Rooms (MDF and IDF)

1. Before any terminations and installation of equipment, the TR must be in its finished stage. Free of dust and debris with all walls and ceiling painted to finish coat and floors installed or treated. This shall include lighting and functioning HVAC system to maintain environmental conditions. This will need to be coordinated with the building / project schedule for Fire Alarm, Elevator, Building Automation Systems and Access Controls testing, inspections and certifications. Contractor is responsible for dust, debris and moisture. After terminations and equipment are installed, the TR's door must be kept closed and locked at all times.

B. Riser Conduits

1. Provide a conduit system for the delivery of all cable from the main distribution area to each telecommunications room. The conduit system must be sized to meet a 50% growth factor and accommodate the usable square footage in support of workstation growth. A minimum of (4) 4-inch vertical riser conduits or sleeves are required between TR's. They must be installed as close to a corner in the TR as possible. Label conduits at both ends.

C. Cable Tray

1. It is important that the path for the cable tray is clear of obstructions, such as HVAC ducts, large pipes and structural beams within the building. Where fire or smoke barriers are penetrated by the cable tray, they shall be fire stopped to maintain the rating of the barrier. Alternatively, conduit sleeves may be used through the penetrations which must be fire stopped as well. The number of sleeves required depends on the number of cables and size of the tray. Use 50% fill ratio to determine the number of sleeves. Two additional spare sleeves should be installed to accommodate future cable placement.

2. Place cable trays above drop ceilings in corridors. Do not place them above offices or inaccessible spaces. Cable trays shall run flat and level with minimal rise and fall in elevation along the entire run. There must be at least 4 inches of vertical space between the suspended ceiling tile and the bottom of the cable tray; 12 inches of vertical clearance from the top of the cable tray is required; and 2' total side clearance (meaning, if the cable tray is wall mounted and there is no clearance on one side, then minimum clearance on the other side should be 2').

3. Access ceiling panels must be installed at 10-foot intervals and at every junction and turn if cable tray is passing through a hard-lid ceiling. The panels should be within 2 feet from the cable tray. They shall not be mounted directly underneath the cable tray.

4. No other building services cabling shall be located in the cable tray. Locate all other services cabling such as Fire Alarm cabling, Security cabling, audio/visual cabling, etc., in separate cable pathways.

5. Manufacture and model of all proposed termination equipment must be approved by the City. The capacity of the patch panels (48 port) will be sized during the construction stage. The patch panel must conform to EIA/TIA 568B wiring standards. The layout of patch panels and data devices will be defined during the construction stage.

6. The wiring to the patch panel must comply with EIA/TIA568B wiring standards. Patch cords connecting the patch panel to the data Layer 2 switch must also be EIA/TIA 568B compliant. Horizontal and vertical cable managers must also be provided for a neat and functional rack system.

7. Data communications cabinets shall be sized to accommodate immediate cable requirement plus 25% growth. Fiber terminations will be installed at the top of both racks in an appropriate size rack-mounted fiber patch panel using an LC termination/interface.

8. 2RU Horizontal cable managers with extended fingers shall be placed above and below each patch panel.

9. Front and rear vertical cable managers shall be placed between each equipment rack and 6" front and rear vertical cable managers on each end of the equipment rack set. Install dividers in each vertical cable manager.

10. 12" ladder rack shall be installed in Telecommunication Rooms as specified and approved by the owner and installed by the cabling contractor including all miscellaneous parts required for a complete ladder rack system surrounding the room for a complete ladder rack system. Tie in the ladder tray to the cable basket tray system. Install ladder tray 12 inches above equipment racks utilizing threaded rod to provide a waterfall for the cabling.

11. Provide all cabling and cable termination equipment to support the voice and data communications requirements from the local exchange company LEC MPOE to the main distribution area. Provide vertical cable and termination equipment from the main distribution area to all telecommunications rooms on each floor.

D. Category 6 UTP Testing
   1. At the completion of the installation and termination of all voice and data wiring in each building, all cable must be tested (Permanent Link). Testing will verify for proper operation per specifications.
   2. A twisted pair transmission analyzer will be used for all data cable to confirm bi-directional compliance with EIA/TIA 568B standards and 10G Base-T Ethernet, recording the test results per cable pair.

E. Verification
   1. Provide City staff an electronic copy of the results of all cable testing. The installer will be responsible for the repair and/or replacement of any cable that does not meet specifications. The contractor will provide documentation including test results on each fiber and the test equipment utilized. Contractual obligations will not be complete until all cables/fiber etc., achieve manufacturer's specifications or higher. Network services or network components will not be installed until all cable test results are complete.

END OF SECTION 271100

SECTION 271300 - COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cable.
3. 50/125-micrometer, optical fiber cabling.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Cabling identification products.

B. Related Sections:

1. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.2 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. UTP: Unshielded twisted pair.

1.3 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration drawings and printouts.
3. Wiring diagrams to show typical wiring schematics including the following:

    a. Cross-connects.
    b. Patch panels.
    c. Patch cords.

4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance Data: For splices and connectors to include in maintenance manuals.

G. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Telecommunications Pathways and Spaces: Comply with TIA-569-C.

E. Grounding: Comply with ANSI/TIA-607-B.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
1. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
2. Test each pair of UTP cable for open and short circuits.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA-569-C.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, the following:

1. General Cable Technologies Corporation.

2. Or equivalent.

B. Description: 100-ohm, 50-pair UTP, formed into 25-pair binder groups covered with a gray thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA-568-C.1 for performance specifications.
3. Comply with TIA-568-C.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, General Purpose: Type CM or CMG.
b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
c. Communications, Riser Rated: Type CMR, complying with UL 1666.
d. Communications, Limited Purpose: Type CMX.
e. Multipurpose: Type MP or MPG.
f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Panduit Corp.

2. Or equivalent.

B. General Requirements for Cable Connecting Hardware: Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

E. Patch Cords: Factory-made, 4-pair cables in 1-m lengths; terminated with 8-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.5 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, the following:

1. General Cable Technologies Corporation.
2. Optical Cable Corporation, Roanoke, Virginia.

B. Description: Multimode, 50/125-micrometer, 24-fiber, nonconductive**,** tight buffer, optical fiber cable equivalent to 10-gigabit OM3.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with TIA-492AAAA-B for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

a. General Purpose, Nonconductive: Type OFN or OFNG.
b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
d. General Purpose, Conductive: Type OFC or OFCG.
e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.

5. Conductive cable shall be aluminum armored type.
6. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Description: Singlemode Fiber Optic Cable

1. Provide singlemode fiber optic cable with strand counts as noted on the plans and block/riser diagrams.
2. Cable shall have the following characteristics:
   a. 8.3-micron core (OS2)
   b. Outer jacket shall be yellow in color
   c. Fibers shall be grouped into 12 strand bundles (tubes) and each tube shall be color coded
   d. Each fiber within each tube shall be provided with a colored jacket.
   e. Fiber shall be indoor rated and have a 32°F to 140°F installation temperature and an operational temperature from 32°F to 158°F.
   f. Cable shall be loose tube design
   g. Maximum attenuation shall be 0.4 dB/km @ 1310 nm and 0.3 dB/km @ 1510 nm.
   h. Cable shall be capable of supporting 1470, 1490, 1510, 1530, 1550, 1570, 1590 and 1610 nm wavelengths.
3. Singlemode optical fiber connectors:
   a. Provide SC type connectors with fusion spliced terminations.
   b. Insertion loss of mated pair at 1310 nm to be less than 0.5 dB at acceptance for every duplex connector.
   c. Optimally keyed, allowing reproducible mating conditions each time a connection is made between connector and coupler.
   d. Fitted with strain relief boots to ensure durable and robust connections
   e. Durability better than 500 matings, with a maximum increase in insertion loss of not more than 0.2 dB.
   f. Fitted with a tight polymer cap over the connector to prevent ingress of dirt and dust, until the connector is fitted to a coupler.

D. Jacket:

1. Jacket Color: Aqua for 50/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Panduit Corp.
2. Optical Cable Corporation, Roanoke, Virginia.

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2, TIA-604-3-B, and TIA-604-12. Comply with TIA-568-C.3.
2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.
3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA-569-C.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA-569-C for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches (76 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA-568-C.3.

2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

3.5 Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.6 FIRESTOPPING

A. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.7 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI/TIA-607-B.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.8 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Administration Class: 2.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Division 09 Section "Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about TIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration including optional identification requirements of this standard.

D. Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.

E. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

G. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA-606-B, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test

Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical Fiber Cable Tests:

   a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:

      1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA-526-14-B, Method B, One Reference Jumper.
      2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA-568-C.1.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 271300

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

1.1 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cabling.
3. Multiuser telecommunications outlet assemblies.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Telecommunications outlet/connectors.
6. Cabling system identification products.
7. Cable management system.

B. Related Sections:

1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
2. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.2 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.

D. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

F. EMI: Electromagnetic interference.

G. IDC: Insulation displacement connector.

H. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

I. LAN: Local area network.

J. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.

K. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

L. RCDD: Registered Communications Distribution Designer.

M. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom without ventilation openings.

N. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.

O. UTP: Unshielded twisted pair.

1.3 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. TIA-568-C.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

2. Cabling administration drawings and printouts.
3. Wiring diagrams to show typical wiring schematics, including the following:

    a. Cross-connects.
    b. Patch panels.
    c. Patch cords.

4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
5. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

    a. Vertical and horizontal offsets and transitions.
    b. Clearances for access above and to side of cable trays.
    c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
    d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Telecommunications Pathways and Spaces: Comply with TIA-569-C.

E. Grounding: Comply with ANSI/TIA-607-B.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.
   2. Test each pair of UTP cable for open and short circuits.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA-569-C.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

   1. Support brackets with cable tie slots for fastening cable ties to brackets.
   2. Lacing bars, spools, J-hooks, and D-rings.
   3. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

   1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, following:

1. General Cable Technologies Corporation.

B. Description: 100-ohm, 4-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA-568-C.1 for performance specifications.
3. Comply with TIA-568-C.2, Category 6 .
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

    a. Communications, General Purpose: Type CM or CMG.
    b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    d. Communications, Limited Purpose: Type CMX.
    e. Multipurpose: Type MP or MPG.
    f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, the following:

1. Panduit Corp.

B. General Requirements for Cable Connecting Hardware: Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair UTP cable indicated, plus spares and blank positions adequate to suit specified expansion criteria.

D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

E. Patch Cords: Factory-made, four-pair cables in 1-m lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.5 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA-568-C.1.

B. Workstation Outlets: as indicated on the drawings.
1. Metal Faceplate: Stainless steel, complying with requirements in Division 26 Section "Wiring Devices."
2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.

a. Flush mounting jacks, positioning the cord at a 45-degree angle.

3. Legend: Factory labeled by silk-screening or engraving for stainless steel faceplates.

2.6 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with ANSI-TIA-607-B.

2.7 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA-569-C.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA-569-C for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches (76 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. MUTOA shall not be used as a cross-connect point.
4. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.

5. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
12. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-C for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

3.5 Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.6 FIRESTOPPING

A. Comply with TIA-569-C, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.7 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-TIA-607-B.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.8 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Administration Class: 2.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Division 09 Section "Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration, including optional identification requirements of this standard.

D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

F. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA-606-B.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. UTP Performance Tests:

    a. Test for each outlet and MUTOA. Perform the following tests according to TIA-568-C.1 and TIA-568-C.2:

        1) Wire map.
        2) Length (physical vs. electrical, and length requirements).
        3) Insertion loss.
        4) Near-end crosstalk (NEXT) loss.

5) Power sum near-end crosstalk (PSNEXT) loss.
6) Equal-level far-end crosstalk (ELFEXT).
7) Power sum equal-level far-end crosstalk (PSELFEXT).
8) Return loss.
9) Propagation delay.
10) Delay skew.

5. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA-568-C.1 and TIA-568-C.3.

C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 271500

SECTION 275227 – ELEVATOR 2-WAY INTERCOM SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: One complete Elevator 2-Way Intercom System complete with components specified herein and cabling in conduits with devices, outlet boxes, enclosures, faceplates, telephone system cabling and connections, Master Station and Area Stations. Install equipment as indicated on the drawings. See Division 26 for conduits and see Section 27 10 00 for outlet boxes.

1. Conduit and boxes.
2. Cabling.
3. Faceplates and enclosures.
4. Master Station with Auto-Dialer (may be separate adjacent enclosures).
5. Area Stations.

B. Related Sections: Division 26 - Electrical.

1.3 GENERAL OPERATION AND DESCRIPTION:

A. General

1. The system shall be vandal resistant, manufactured of 16 gauge (0.062) 304 stainless steel and comply with the Americans with Disabilities Act sections 4.3.11.4 and 4.3.11.5.
2. The Master Station and Area Stations shall be custom engraved (not silk screened or stamped).
3. The Area Station shall have a large domed, stainless steel engraved 3" diameter momentary pushbutton with the words "Push for Help" backfill painted in bright red. The momentary button shall be "heavy duty" and the surface engraving shall be deep enough to withstand extreme conditions. It shall be activated with a minimum of effort and engineered so that it may be depressed from any angle for ease of use provided. No other hardware shall protrude from the station as high as the pushbutton.
4. The system's Area Stations shall also be weather resistant.
5. The system shall be modular and expandable to include future Area Stations.
6. The wire shall be 7 conductor 3 pair + one conductor 20 AWG with an overall shield.

1.4 QUALITY ASSURANCE

A. Source Quality Control: Materials and equipment shall be new, unused and U.L. listed.

1. Furnish Manufacturer's manuals of the completed system including individual specification sheets, schematics, inter-panel and intra-panel wiring diagrams. In addition, all information necessary for the proper operation of the system must be included.
2. As built drawings that include any changes to wiring, wiring designations, junction box labeling and any other pertinent information shall be supplied upon completion of project.

1.5 REFERENCES

A. The complete installation, including additions and modifications, shall be in accordance with:

1. The 2014 National Electrical Code Article 800.
2. Minimum standards of Electronic Industries Association (ETA).

1.6 SUBMITTALS

A. Submit shop drawings, analysis and product data.

1. Shop Drawings: The contractor shall provide a one-line riser diagram indicating route and conduit size, power wiring and connections of system to the Owner's equipment, as purchased.
2. Product Data: Submit application, technical and installation data.

B. Submit Operation and Maintenance Manuals.

1. O&M manuals shall include a list of each stations location with space number.

1.7 WARRANTY, SERVICES

A. The Elevator 2-Way Intercom System wiring installer shall warrant the system for a minimum of one (1) year from date of Substantial Completion against defective parts and/or workmanship, excluding normal burnout of lamps, and shall provide parts and labor to fulfill this warranty at no cost to Owner.

B. Qualified service and parts shall be available to call on within a 150 mile basis.

1.8 BASIS OF DESIGN

A. Housing Devices, Inc. shall be the basis of design.

PART 2 - PRODUCTS

2.1 BASIC SYSTEM OPERATION

A. When the system is in normal operating mode, the Master Station shall display an illuminated "green" LED system ready light indicating the system is functioning and operating correctly. When operated, the system shall provide two-way audio and visual communications between the Master Station location and each Area Station initiating a request for help. Communication at each Area Station shall be hands-free after initial contact from the Area Station.

B. When a "call for help" is placed by an Area Station, the system shall initiate audio and visual alarms at both the Master Station and each of the affected Area Stations. The audible alarm shall be at least 90 decibels and the visual display shall be indicated by a SuperBrite® LED light and surface engraved or attached engraved location name (ID) directory of the calling Area Station.

C. Communication is established by simply answering via the Master Station. When communication is completed and the Master Station communication link has been broken, the LED display will continue to show the Area Station location (ID) until the system has been reset at the Master Station.

D. When a "call for help" is placed by an Area Station, several indications must be provided at the Area Station to assure the caller that the call is being processed. After pressing the 3" "Push For Help" call button the caller will be provided with both an audio and visual confirmation. A "Help Requested" LED shall illuminate and an alarm will sound at both the Area Station and the Master Station. When the security attendant at the Master Station has answered the call, the "Help Coming" LED will illuminate and the security attendant's voice can be heard through the speaker at the Area Station. Full two-way voice "hands-free" communication shall be provided at the Area Stations. The caller simply talks in the direction of the Area Station speaker, which acts as a microphone and enables the caller's voice to be reproduced at the Master Station. Upon completion of the call, an LED on the Area Station indicating "Help Coming" shall remain illuminated, providing visual indication that the "HELP REQUESTED" LED is acknowledged from the Master Station. The LED will not extinguish until building personnel have reported to the Elevator 2-Way Intercom System has been reset. Resetting the system shall be accomplished by turning a momentary key switch at the Master Station.

E. Upon signal from Master Station (if call to Master Station is not answered within a programmed time period), Auto Voice Phone Dialer shall dial programmed phone numbers and transmit recorded message, repeated 3 times.

2.2 MASTER STATION

A. The Master Station shall be constructed of 16 gauge 304 stainless steel. The station faceplate shall be 11"W x 11"H, be capable of surface or flush mounting and utilize tamper proof mounting hardware. It shall include the following:

1. Panel capacity for the indicated number of Area Stations.
2. Two 7/16" diameter flat metal buttons ("Talk", "Listen") per Area Station to initiate and respond to a request for assistance from each specific Area Station in the system.
3. When in standby mode, a "green" LED shall be illuminated to indicate the system is operational. Depressing the "Talk" button shall illuminate a "Help Coming" LED at the respective Area Station, silence the piezoelectric alarm, and open up two-way voice communication between the Master Station and Area Station(s).
4. Two SuperBrite® colored LEDs per Area Station to visually indicate "Help Requested" (red LED) or a line fault (amber LED) for each specific Area Station in the system, and to indicate that a fault has occurred at a particular Area Station(s), wiring between Area Station(s) and Master Station, or other system components shall be provided.
5. A piezoelectric alarm shall generate a 90 dbA signal sounding through the Master Station to aurally indicate "Help Requested" from an Area Station.
6. An audio confirmation signal shall be generated from the Master to the Area Station to acknowledge the request for assistance.

7. Acknowledgment of the "Help Requested" call from the Area Station to the Master Station shall also be indicated at the Area Station by the illumination of a red LED ("Help Coming") on the Area Station.
8. The system shall be able to provide an optional set of N/O dry contacts (if specified) for connection to a secondary Master Station, paging system, fire alarm system, or other optional devices such as AVPD telephone dialer or PBX telephone system. All communication between Master Stations or DTMF telephones shall be non-blocking.
9. The system shall have the capability to add Master Stations and sub-annunciator panels as specified.
10. It shall be possible to redirect "Help Requested" calls to a secondary Master Station, PBX system, or other outside telephone if there is no answer at the primary Master Station.
11. Provide battery backup capable of sustaining equipment for 90 minutes under normal operating conditions, and 24 hours in standby mode.

2.3 AUTO VOICE PHONE DIALER

A. Provide Auto Voice Phone Dialer (AVPD), Housing Devices model ADA-2001 or approved equal.
B. AVPD shall Store up to 4numbers in EPROM for dialing voice phones, numeric and/or voice pagers. Numbers may be up to 50 digits long with multiple PAUSE segments. A PAUSE is 2 seconds long & contains 1 digit.
C. Provide with LCD numeric display, 16-character 2-line display of program, test, and status.
D. AVPD shall have EPROM memory to store voice messages, phone numbers, and dialer status information even after total power failure (including removal of battery).
E. AVPD shall be 24V powered from the Master Station, with 9V battery to provide 24 hours standby operation upon loss of normal power.
F. Semi-flush enclosure, 6"x4"x1.5".

2.4 AREA STATIONS

A. The Area Station assembly shall be constructed of 16 gauge 304 stainless steel. The station faceplate shall be 9"W x 9"H, be capable of surface or flush mounting and utilize tamper proof mounting hardware. The faceplate shall have the following features:

1. A large 3" diameter domed stainless steel momentary pushbutton surface engraved and backfill painted in bright red the words "PUSH FOR HELP". It shall be activated with a minimum of effort and engineered so that it may be depressed from any angle for ease of use provided. No other hardware shall protrude from the station as high as the pushbutton.
2. Two "SuperBrite®" red colored LEDs shall visually indicate and confirm request status to the caller with the words "HELP REQUESTED" and "HELP COMING" surface engraved and backfill painted as labels next to each LED.
3. A 3" mylar 45 ohm speaker shall be provided.
4. A piezoelectric alarm shall generate a 90 dbA signal sounding through the Area Station to aurally indicate "HELP REQUESTED" from an Area Station.
5. An extra set of dry contacts shall be provided (if specified) for connection to optional equipment, such as, strobe light, video camera, DTMF dialer, etc.
6. An optional momentary type keyed reset switch shall also be provided, if required. The reset switch will provide the means to reset the "HELP COMING" LED at the Area Station and also reset the corresponding area's red LED on the Master Station in order to ensure response

by building personnel to the caller at the Area Station.

7. Braille Instructional Signs shall be provided for each Area Station. Signs shall be tactile lettering & rastor braille with tamper proof mounting hardware. Text shall conform with the Americans with Disabilities Act Sec. 4.30.4 for text size and style, be in Braille and English, and read: "FOR ASSISTANCE PUSH HELP BUTTON"

2.5 CABLING

A. All cable shall be as recommended by the manufacturer or an approved equivalent. All Area Station wiring shall be home run with individually jacketed cable.

B. Area Station wiring shall be 7 Conductor (3) 20AWG overall shielded twisted pairs + 1 conductor.

C. Master Station wiring shall be 7 Conductor (3) 20AWG overall shielded twisted pairs + 1 conductor.

D. Three (3) 20AWG conductors for each Area Station are also required.

E. All cables run in underground conduits shall be suitable for wet locations and appropriately grounded as per EIA and NEC recommendations. See wiring diagrams for details.

PART 3 – EXECUTION

3.1 INSPECTION

A. System field wiring diagrams shall be provided to the Contractor by the system Manufacturer prior to installation.

B. Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall include part numbers and name, address, and telephone number of parts source.

C. Upon completion of the installation of the equipment, the Contractor shall provide to the Engineer a signed statement that the system has been wired, tested, and functions properly according to the specifications.

D. Nothing herein contained shall be construed to relieve the Contractor from furnishing a complete and acceptable electrical wiring system in all its categories. The Engineer will reject any materials or labor which are or may become detrimental to the accomplishment of the intentions of these specifications.

3.2 INSTALLATION

A. Complete system shall be installed in strict accordance with manufacturer's recommendations.

B. All wiring shall be installed in raceways where routed through ceiling areas.

C. Master Station and Area Station mounting shall be in accordance with the ADA recommendations and specifications.

D. Provide dedicated telephone line in conduit from master station auto-dialer to nearest IDF and connection to telephone system. If call to Master Station is not answered within a programmed time, the system Master Station shall automatically transfer the call to an offsite phone number or numbers designated by the Owner.

3.3 FIELD QUALITY CONTROL

A. General: Upon completion of the installation, the Elevator 2-Way Intercom System Trade's technician shall perform all necessary electrical tests and adjustments and who shall then submit a Letter of Certification to the Owner/Architect/Engineer that the system functions properly.

B. The technician shall perform all electrical and mechanical tests, measurements and adjustments required below. A checkout report shall be prepared by the installation technicians and submitted in triplicate. The report shall include, but not be limited to:

1. A complete list of all wiring components.
2. Indication that all equipment is properly installed and functions and conforms with these specifications.
3. Technician's name, certificate number and date.

C. After completion of all tests, measurements and adjustments listed above, the ARA System Trade shall submit the following information to the Architect/Engineer.

1. "As built" conduit layout diagrams including wire color code and/or tag number.
2. Complete "As built" wiring diagrams.
3. Complete operating and programming instructions, including engineering data sheets on each component and complete part numbers of the each component.

D. Final tests and inspection shall be held in the present of Architect's representatives and to their satisfaction. The Elevator 2-Way Intercom System Trade shall supply personnel and required auxiliary equipment for this test without additional cost.

3.4 TRAINING

A. The Contractor shall furnish training with the system. These sessions shall be broken into segments that will facilitate the training of individuals in operating the Master Station as well as Area Stations. Operating manuals and users guides shall be provided at the time of the training.

END OF SECTION 275227

SECTION 276410 - RADIO FREQUENCY (RF) BDA-BASED SIGNAL BOOSTER SYSTEMS (IN-BUILDING RADIO SYSTEM COVERAGE)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

A. BDA: Bi-directional amplifier in-building radio communication system that brings wireless signals into a structure from outside, amplifies those signals with a signal booster, and then evenly distributes the amplified signals throughout a structure via a Distributed Antenna System (DAS). The system also amplifies signals originating inside the building and transmits them outside.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For headend and distribution system. Include plans, elevations, sections, details and attachments to other work.

1. Show fabrication and installation details for equipment.
2. Functional Block Diagram: Show single-line interconnections between components for headend and distribution system. Show cable types and sizes.
3. Dimensioned Plan and Elevations of Headend Equipment: Show access and workspace requirements.
4. Wiring Diagrams: For power, signal, and control wiring and transmission cable, include cross connects, taps, and other connections cords.

C. Design Calculations: Calculate signal attenuation budget and show calculated line and equipment losses for the system based on the functional block diagram, to show that proposed system layout can be expected to perform up to specification. Calculate signal strength from sources to endpoints. Allowable losses between components and user interface shall be used to determine size and type of cable.

D. Coordination Drawings: Include dimensioned plan and elevation views of components and enclosures. Show access and workspace requirements.

E. Equipment List: Include each piece of equipment and include model number, manufacturer, serial number, location, and date of original installation. Insert testing record of each piece of adjustable equipment, listing name of person testing, date of test, and description of as-left set points.

F. Field quality-control reports.

G. Operation and Maintenance Data: For headend and distribution system to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL

A. The contractor shall design, provide, and warranty a complete signal booster system. The installed system shall include all hardware, bi-directional amplifiers, band-pass filters, surge suppressors, lightning protection, UPS, transmission lines, power cabling, antennas, and other components necessary for a complete operational system as specified and as acceptable to the local authorities having jurisdiction.

2.2 RADIO FREQUENCY (RF) BDA-BASED SIGNAL BOOSTER SYSTEMS

A. In-building signal booster systems shall receive and re-transmit the entire uplink/downlink frequency band utilized by the regional emergency service provider(s)**.** The contractor shall confirm with the regional emergency service provider(s) as to the specific frequencies used by the various agencies. This system shall be state-of-the-art, operating bi-directionally and in full duplex. The system shall be fully compatible with and function on City Staunton Public Safety Radio System. The owner's radio system is Motorola.

B. Completed installations (including cabling) shall comply with all applicable codes and standards, including City Building and Electrical Codes, NFPA, ANSI, NEC, OSHA,EIA, IEEE, R-56, etc., as well as the FCC Rules and Regulations, as applicable. Equipment provided shall be UL listed and FCC type accepted for this specific application. Compliance to codes and standards shall extend to include proper grounding, bonding and surge.

C. The system shall provide digital signal strength coverage over 95% area on each floor/level of the equipped building. Systems shall provide a minimum digital and analog overage of Circuit Merit (CM) 3, with a reliability factor of 95%. A Coverage Acceptance Test shall be executed prior to final acceptance of an installed system. Coverage acceptance testing shall be based on audio quality performance in evenly spaced test grids in the defined service areas. A minimum of 20 tests will be taken per floor/level. Total number of test grids will be determined by the Owner, based on the size of the space per floor/level.

D. Provide uninterruptable power source(s) (UPS) capable of maintaining the system operational for a minimum of 90 minutes.

E. During initial installation, each system shall be optimized to perform in accordance with the specifications set forth in the system design, manufacturer's specifications and FCC regulations. The contractor shall ensure that uplink and downlink levels are properly set and consistent with design expectations. The contractor shall further ensure that noise and spurious products are held within limits set forth in the system design, manufacturer's specifications and FCC regulations. Prior to system acceptance, for each active BDA, booster amplifier, etc., the contractor shall submit a Proof of Performance certification, that lists the design expectations, actual measurements, and if applicable, FCC specifications for the following parameters:

1. Worst case BDA uplink input level, in dBm.
2. Worst case BDA uplink output level, in dBm.
3. BDA downlink input level, in dBm.
4. BDA downlink output level, in dBm.
5. Noise and spurious products, BDA uplink output, in dBc.
6. Noise and spurious products, BDA downlink output, in dBc.

F. The original Proof of Performance report shall be submitted to Owner's project manager, and a copy of the Proof of Performance report shall be affixed to its associated equipment.

G. The system is designated for in-building use and shall be designed and quoted as follows: Design and appearance will be of "finished" construction, i.e. shall be concealed and/or unobtrusive in finished areas. Flush mount ceiling antennae may be acceptable on a case-by-case basis. Unless indicated otherwise, wire mold and surface conduit installations will not be acceptable unless approved in writing by the Architect in advance.

H. Provide dry contacts to send a system monitoring signal to the Fire Alarm System, in accordance with the NFPA.

PART 3 - EXECUTION

3.1 WARRANTY

A. The contractor shall provide a full one-year warranty to cover installation and all equipment, software, and components; the warranty shall commence upon the Owner's final acceptance of the facility. Under warranty coverage, the successful contractor shall provide same business day response time for system malfunctions.

B. The contractor shall perform optimization of each system during the initial warranty period, sixty (60) to ninety (90) days prior to warranty expiration. This optimization task is separate from the initial optimization performed during system installation. The contractor shall include pricing for annual system optimization to be included as part of post-warranty maintenance. Actual scope of work for annual optimization and maintenance will vary on a case-by-case basis, but typically will consist of the following:

1. Optimize the system to perform in accordance with the specifications set forth in the system design, manufacturer's specifications and FCC regulations.
2. Ensure that uplink and downlink levels are properly set and are consistent with design specifications.
3. Ensure that noise and spurious products are held within limits set forth in the system design, manufacturer's specifications and FCC regulations.

C. Update the Proof of Performance records for the system, listing the design expectations, actual measurements, and if applicable, FCC specifications for the following parameters:

1. Worst case BDA uplink input level, in dBm.
2. Worst case BDA uplink output level, in dBm.
3. BDA downlink input level, in dBm.
4. BDA downlink output level, in dBm.
5. Noise and spurious products, BDA uplink output, in dBc.
6. Noise and spurious products, BDA downlink output, in dBc.

D. The updated Proof of Performance report shall be submitted to the Owner, and a copy of the updated Proof of Performance report shall be affixed to its associated equipment.

E. Visually inspect outside antenna installation. Correct any issues found with the antenna mounting hardware, grounding system, or outside cabling.

F. Visually inspect inside BDA or booster amplifier equipment installation. Correct any issues found with RF cabling, electrical connection, or equipment mounting.

G. Clean equipment fans, filters and other ventilation system components.

H. Inspect and replace any defective indicator lights.

I. Test UPS system performance for proper fallback to battery power and the duration of battery operation.

J. Test fault reporting system for proper operation and reporting of system faults.

K. Submit a written Preventive Maintenance Report to the Owner, listing the results of the optimization and preventive maintenance effort. The report shall include the Proof of Performance report for active RF components, and details of any other discrepancies found and corrective actions taken.

L. All as-built drawings shall be submitted to the Owner at completion, which shall include antenna system layout and all associated hardware, along with specification sheets. Include RF measurements taken.

END OF SECTION 276410

SECTION 280500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

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. Electronic safety equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electronic safety installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY PENETRATIONS

A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 280500

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Device guards.
7. Firefighters' smoke-control station.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.

B. Related Requirements:

1. Section 280513 "Conductors and Cables for Fire Alarm System" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to 1/8" = 1'-0" scale; coordinate location of duct smoke detectors and access to them.
    a. Show field wiring required for HVAC unit shutdown on alarm.
    b. Locate detectors according to manufacturer's written recommendations.
13. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by the architect prior to submission to authorities having jurisdiction.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level IV minimum or a Professional Engineer registered in the state where the project is being constructed as required by the Local Authority Having Jurisdiction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.6 Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Record copy of site-specific software.
g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

h. Manufacturer's required maintenance related to system warranty requirements.
i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

1.9 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Flame detectors.
4. Smoke detectors.
5. Duct smoke detectors.

6. Automatic sprinkler system water flow.
7. Fire standpipe system.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
6. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
8. Recall elevators to primary or alternate recall floors.
9. Activate elevator power shunt trip.
10. Activate emergency lighting control.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit.
3. fter a time delay of 120 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
4. Transmit system status to building management system.

2.3 Combined Fire-alarm Control Unit

(Refer to Fire Alarm and Mass Notification System Riser Diagram show on E4.4 for additional information)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. SimplexGrinnell LP. (Basic of Design)

2. Gamewell - FCI by Honeywell.
3. Notifier.

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

    a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder.
    c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    d. The FACP shall be listed for connection to a central station signaling system service.
    e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class A.
2. Pathway Survivability: Level 1.
3. Install no more than 100 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

    a. One dedicated RS 485 port for remote station operation using point ID DACT.
    b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).

E. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

F. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

G. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

    a. Elevator lobby detectors except the lobby detector on the designated floor.
    b. Smoke detector in elevator machine room.
    c. Smoke detectors in elevator hoistway.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

    a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

K. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

L. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. SimplexGrinnell LP
2. Notifier.
3. Gamewell - FCI by Honeywell.

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod and pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.5 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. SimplexGrinnell LP. .

2. Notifier.
3. Gamewell - FCI by Honeywell .

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    c. Multiple levels of detection sensitivity for each sensor.
    d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.

c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. SimplexGrinnell LP.
2. Notifier.
3. Gamewell - FCI by Honeywell

B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. SimplexGrinnell LP.
2. Siemens Industry, Inc.; Fire Safety Division.

3. Federal Signal Corporation.

B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

D. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

E. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

F. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

G. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

2.8 FIREFIGHTERS' SMOKE-CONTROL SYSTEM

A. Smoke Control System Sequence: In accordance with VUSBC and IBC 909-17, the smoke control system shall activate components in an appropriate sequence. Fans, dampers, damper position dry contacts, differential air pressure switches and other components of the Smoke Control Systems are furnished and installed by Division 23. Refer to Division 23 Contract Documents and coordinate work with Div 23. Each step in the sequence has a time duration, which shall be listed in the Contactor's sequence submittal with incremental and total time required for operation. In principle, minimum sequence steps include but are not limited to:

1. Smoke Detector detects smoke. FA system resets detector and waits for automatic alarm verification before initiating alarm and smoke control sequence. Up to 15 seconds duration.
2. System sends signal to FA control module(s) to open/close appropriate dampers and, where applicable, shut down HVAC systems. Up to 20 seconds duration.
3. System receives confirmation from damper monitor modules that dampers are in correct position. Up to 10 seconds duration.
4. System sends signal to FA control module(s) to activate smoke control fans. Up to 5 seconds duration.
5. System receives confirmation from monitor module at smoke fan motor differential pressure switch relays that associated fan(s) are operational. Up to 10 seconds duration.
6. Total sequence duration: 15 + 20 + 10 + 5 + 10 = 60 seconds delay from detection of smoke until full system operation.

a. If a flow switch causes smoke control system activation, the 15-second smoke verification delay for smoke detector activation (item 1 above) shall not occur (allow 5 seconds for flow switch) bringing the total to 50 seconds.

B. Addressable Relay Modules:

1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
2. Allow the control panel to switch the relay contacts on command.
3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
4. Listed for controlling HVAC fan motor controllers.

2.9 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 NETWORK COMMUNICATIONS

A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.

B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.

2.13 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

H. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

J. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

A. Cabling shall be installed in EMT.

B. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
   1. Smoke dampers in air ducts of designated HVAC duct systems.
   2. Electronically locked doors and access gates.
   3. Alarm-initiating connection to elevator recall system and components.
   4. Alarm-initiating connection to activate emergency lighting control.
   5. Supervisory connections at valve supervisory switches.
   6. Supervisory connections at elevator shunt-trip breaker.
   7. Data communication circuits for connection to building management system.
   8. Supervisory connections at fire-extinguisher locations.

C. Connect two dedicated active telephone lines to the DACT; coordinate with communications system installer.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 REMOTE MONITORING SERVICE

A. Engage a licensed remote monitoring facility to monitor the fire alarm system. This shall be for a period of at least 12 months following substantial completion (full warranty period). The Owner shall be the designated point of contact for the remote monitoring facility. After the first 12 months, monitoring service shall be transferrable to the Owner.
   1. Provide a Contract option for the Owner to extend the remote monitoring service contract to 2, 3, 4 or 5 years, to be honored any time during the initial 12-month period.

B. If the Owner has a preferred licensed remote monitoring facility other than that proposed by the Fire Alarm subcontractor, credit Contract an amount equal to 1 year monitoring service and coordinate with Owner's monitoring service.

3.7 Program the DACT to dial the telephone number(s) of the licensed remote monitoring facility.

3.8 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.9 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.10 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.11 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111

SECTION 285000 - SECURITY CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 DESCRIPTION OF WORK

A. The general contractor shall contract the services of a qualified Security Controls System Contractor (SCSC) and shall be responsible for the Security Controls System Contractor (SCSC) and the systems they shall provide as part of the Division 28 specification sections.

B. All Work associated with a complete and fully functional Security Control System shall be provided by the Security Controls System Contractor (SCSC). This Work and system shall include, but may not be limited to, all conduit, raceway, wire, terminations, backboxes, devices, equipment, products, services, and overall systems integration. The installation or furnishing of such Work by other trades, including the Electrical Subcontractor, shall not be acceptable unless they are a direct subcontractor to the SCSC.

C. The SCSC shall provide all equipment, shop drawing submittals, testing reports, and samples as described in Specification Sections 285000, 285010, 285020, 285030, 285100, 285200, 285260, 285300, 285400, 285500, and 285900.

D. The SCSC shall provide a software data flow diagram/chart indicating in what programs and where all control logic will reside. Provide a detailed description of software solution and all secondary software or drivers used to interface or integrate all the security systems. All computers listed throughout the security control system in specification sections 285000 – 285900 shall use Windows 10 or better operating system. All servers listed throughout the Security Control System specification sections 285000 – 285900 shall use Windows Server 2016 or better.

E. All software shall be readily available through conventional sources and all programming shall be written utilizing language simplistic enough to be modified in the future by Owner's qualified staff or a third party integrator. If it is found the SCSC provided non-modifiable programming language or encrypted software but did not disclose this information, the system shall be completely redeveloped with modifiable programming methods at the SCSC's expense.

F. The SCSC shall turn over to the Owner all programming passwords, source codes and programming schedules at Substantial Completion. Prior to final payment, the SCSC shall provide all software, licenses, information, training, and any other items needed to allow the Owner to make future modifications to programming utilizing options other than the original SCSC.

G. Summary

1. The SCSC shall be responsible for coordinating with Division 8, Division 11, and Division 26, the power and cabling requirements of all electric strikes, electric locks, door position indicators, or any other device associated with and controlled/monitored by the Security Control System. This coordination includes the identification and resolution of potential conflicts in the scope of work between these Divisions.
2. Types of Security Control System components/features/interfaces:
    a. The SCSC shall be responsible for all Division 28 field device installation, terminations, and equipment configuration.

b. Provide a complete fully functional Security Control System.
c. Provide all conduit, raceway, wire, terminations, backboxes, and equipment for a complete system. All security cabling shall be in conduit the entire distance of the run unless otherwise noted.
d. Provide proper control of detention hardware as supplied by Division 11 and security hardware as supplied by Division 8. Coordinate all architectural doors with security devices to ensure proper lock, lock power, and control wiring to these locations.
e. Provide all necessary distributed AC/DC system power, unless otherwise noted.
f. The complete Security Control System shall be connected through UPS power and generator power.
    1) Provide interface with UPS to VGUI system for annunciation of UPS trouble alarms on the VGUI.
    2) Provide interface with emergency generator to VGUI system for annunciation of generator trouble alarms on the VGUI.
g. Prior to fabrication, coordinate exact location and installation of Security Control System with other trades.
h. Provide complete system test and written operational certification to the Architect/Engineer and Owner prior to substantial completion.
i. Provide Owner training by factory-trained and authorized personnel as specified.
j. Turn over to Owner all termination point and interconnection schedules, all programming source codes including VGUI software, PLC development software, VMS software, VMS viewing software, video system software and applicable license required for operations. This is to also include the VGUI and security management system and runtime licenses.
k. Flat VGUI panel Control Consoles to integrate the controlling and monitoring of all doors, alarms, video, intercoms, card access and other designated device annunciations. VGUI Control shall have the ability to monitor all security devices and components throughout the entire facility during normal operations.
l. VGUI control and card reader interface with secure elevator.
m. Audio Communications system.
n. Provide IP based color video System with network video recording.
o. Provide Video Client workstations as indicated on the drawings.
p. Provide cameras, lenses, housings and accessories for interior and exterior applications.
q. Provide complete Access Control System and interface with indicated architectural doors, barrier arm gates and pedestrian gates for remote control and/or monitoring. Coordinate with the Owner to ensure the Access Control System provided under this contract can use all types of cards and credentials currently being used by the Owner. Provide interface with existing access control system.
r. Provide all furniture-mounted and wall-mounted duress alarms
s. Provide Security System Interface, cabling & connection for remote warranty troubleshooting and maintenance. Coordinate VPN connection with the Owner's IT department during submittals. Connection shall be able to be physically disconnected when use is not required.
t. Interface to plumbing system for water shutoff in holding areas via VGUI control.
u. Interface to lighting control for holding areas via VGUI control.
v. Provide Talk-thru Units (TTU) and Talk-thru Communicators (TTC).

w. Coordinate all lighting pole mounted camera locations with Division 26. Coordinate conduit, wiring, and termination responsibility.
x. Provide all spare components as specified.
y. Provide walk-through metal detectors (magnetometers) and X-ray units as indicated on contract documents.
z. Other controls, annunciation & monitoring indicated in the Division 285xxx specification sections and on the Drawings.

H. Electrical Contractor: (SCSC shall coordinate with EC & GC)
1. Coordinate all electrical requirements with both the SCSC and General Contractor.
2. The Division 26 contractor shall be responsible for the coordination of conduits/cable raceways of architectural door frames with security hardware provided by Division 8. The SCSC shall be responsible for coordinating with Division 8, Division 11, and Division 26, for the power and cabling requirements of all electric strikes, locks, door position switches, or any other device associated and controlled/monitored by the Security Control System.
3. Provide termination of all 120-volt power connections required by the Security Control System for the computer and monitoring equipment at various security control stations.
4. Lighting and Receptacle control relays and terminations shall be done by the electrical contractor. SCSC to coordinate interface to relays and termination of outputs.
5. Provide all 120V power connections from emergency/generator power panels.
6. Coordinate with the SCSC and provide 120V power for:
a. At the vehicle drive up card reader / intercom / camera post
b. At all power supplies in hardware sets for architectural doors, as listed in Specification Section 087100 – Door Hardware.

I. General Contractor: (SCSC shall coordinate and make the GC aware of these requirements)
1. Coordinate the inter-related work of the SCSC, Div. 11, Div. 8, millwork provider, and Div. 26 Contractors.
2. Include detailed scheduling information for Security Control System installation and testing in the construction schedule. Provide the SCSC two months of testing and troubleshooting of the installation of his equipment near the end of the project. When the system is completely installed, provide the SCSC free access and total control with no other construction traffic for a period of two weeks for proper testing and certification of the system.
3. Provide coordination to ensure that control rooms and Security Electronics rooms are completed as early as possible to facilitate installation of control wiring. Control room(s) and Security Electronics equipment room(s) shall be free of airborne contaminants from cutting, grinding, painting, masonry work, etc., prior to the installation of any Security Electronics equipment. HVAC system must be started and running at a temperature and humidity level required for the operation of the equipment in the spaces.
4. Conduct periodic coordination meetings between security, electrical, plumbing, masonry and all other contractors to make everyone aware of critical areas of construction. Distribute the meeting minutes and attendance to the Architect/Engineer and Owner.
5. Provide coordination with the SCSC to complete the inspections, submittal and closeout documentation as described in the general provisions.

J. Detention Equipment Contractor (DEC):

1. Coordinate with the General Contractor, Electrical Contractor and SCSC.
2. Furnish, install, and terminate detention hardware.
3. Provide all the necessary and proper adjustments for correct hardware operation.

1.3 QUALITY ASSURANCE

A. Work shall be in accordance with the applicable federal, state, and local codes or standards current at the commencement of installation. Where more than one code or regulation is applicable, the more stringent shall apply. All Security Contractor Licensing requirements for contractors and subcontractors shall be enforced as per applicable codes and statutes (refer to the Virginia Department of Criminal Justice Services; www.dcjs.virginia.gov).

B. Cable installation, identification and termination shall be performed in accordance with the Manufacturer's technical installation guidance, in addition to the applicable codes and statutes.

C. All conduit within the secure perimeter shall be concealed when possible. If exposed, all conduit shall be mounted as close to ceiling as possible. Conduit, backboxes, and devices shall be mounted tight to the surface utilizing tamper resistant security screws.

D. All screws and fasteners for the new equipment within the security perimeter shall be tamper resistant security screws, requiring a special tool.

E. In the absence of the Manufacturer's recommendations on conductor applications, the Security Control Systems Contractor (SCSC) shall ensure that the cabling selected meets all technical requirements of the equipment to be installed.

F. An SCSC is required for this project. It is critical that the SCSC understands and meets the requirements of the Contract Documents, the equipment specified and security control systems integration. And, that the equipment is properly installed and functionally ready for use at time of completion specified for the facilities.

G. Division and separation of total responsibility for contract delivery of the security control systems will not be acceptable.

H. The SCSC shall be able to respond on site with qualified personnel to emergency service within 12 hours of notification.

I. The SCSC shall be responsible for providing a complete security control system. This shall include but not be limited to, cabling, cabling raceways, terminations of all system cabling, all distributed AC and/or DC power, field devices and control components, systems start-up, acceptance testing, training, and the complete and total integration of all systems utilizing 'In-House' software programming expertise.

J. Available Security Control System Contractors (SCSC):
1. Accurate Controls Inc. – Ripon, WI
2. Cornerstone – Madison, AL
3. Pavion – Mechanicsville, VA
4. Esitech Inc. – Richmond, VA
5. Johnson Controls – Montgomery, AL
6. Montgomery Technology Inc. (MTI) – Greenville, AL
7. Stanley Security Solutions, Noblesville, IN
8. South Western Communications – Decatur, AL

K. It is not, however, the intent of the Owner or Architect to unfairly restrict competition. Other equally competent SCSCs who meet the 'qualification criteria' specified herein shall be added to the list of 'Available Security Control System Contractors (SCSC)' by addendum. Verbal approval will not satisfy this requirement. Grounds for disqualification shall exist if, in the opinion of the Architect, the information submitted is inaccurate or does not comply with the requirements of this specification. There will be no exceptions. All competent non-listed SCSCs may request to be listed by submitting the data requested in the paragraph 'Qualification Criteria for the SCSC', a minimum of fifteen (15) days prior to bid receipt date. If the bid date is extended for any reason, the qualification period will not be extended.

L. Qualification Criteria for the SCSC

1. Contractor Qualification Statement AIA–A305 shall be filled out in its entirety. Some of the additional criteria in this section may have similar requirements as those found in the A305 form, but such similarities shall not create an exemption to answer the questions on the A305 form.
2. The SCSC shall have been actively engaged in the design and delivery of electronics security control system solutions. Provide a historical narrative of the company from inception; including history of ownership, partnership, incorporation and/or other organizational information. Include information on the growth of the firm over time to include number of employees, relocation(s) of the firm, mergers and acquisitions. Use only the current corporate/business entity, intending on bidding and performing the work.
3. Provide documentation of experience. List two (2) projects completed in the last 10 years for the state in which this project is located. Out of state experience will not be considered. List only projects with cost of security electronics portion in excess of $165,000 and of similar scope. Documentation is to include project names, addresses, description of systems, and the names, addresses, telephone numbers, and contact persons of the contractor and/or owner for whom the work was done.
4. Provide statement that firm has been in business for minimum of five continuous years under the current name.
5. Provide a resume of all key employees in supervisory positions; include their current position, time of service in current position, years as a full-time employee of the SCSC, and number of years of experience in the corrections and criminal justice markets.
6. Submit a block diagram of two previous projects which are similar in scope outlining all major and minor system components within the security control system as well as related systems, describing the integration of both hardware and software required for the complete system.
7. List of projects currently under construction including project size, scope and location.
8. Submit a listing of all jobs which the SCSC is presently or has been involved in litigation and the status thereof.
9. Provide a list of all jobs where your firm has been involved in liquidated damages or where delay damages were filed against your firm.
10. Submit a current letter from the proposed security control system equipment manufacturer's stating that the SCSC is factory trained, fully authorized distributor and installer of their complete line of products.
11. Provide signed statement that SCSC has not been found guilty of charges relating to conflicts of interest or to any criminal activity relating to construction methods, bidding, bid rigging, or bribery in the past five years.

12. Provide signed statement that SCSC has not been found guilty of charges relating to employment of illegal aliens on construction projects in the past five years.
13. Provide a letter from 'A' rated surety company that your company will be able to provide a Performance/Payment bond for this project if awarded the project.
14. The SCSC shall have sufficient financial ability to perform the contract that would result from such procurement. If a bond is required to ensure performance of a contract, evidence that the Contractor can acquire a surety bond from a corporation included on the United States Treasury list of acceptable surety corporations in the amount and type required by the public body shall be sufficient to establish the financial ability of such SCSC to perform the contract resulting from such procurement.
15. Name, address and telephone number of organization's current Bonding Company and level of bonding capacity.
16. The SCSC shall indicate complete and total compliance with the provisions of this specification by letter signed by an officer of the corporation or a principal if other ownership currently exists.
17. Provide the security control system contractor's license number.

1.4 SECURITY CONTROL SYSTEM TRAINING

A. Provide supervisory, operational, and maintenance training outlines and training materials thirty (30) days prior to training.

B. Provide complete supervisory and operator training for the Owner's personnel at the end of construction.
   1. Provide three (3) eight-hour sessions on consecutive days at times set by the Owner. This may include 2nd and 3rd shift times to accommodate all officers. These should be scheduled as part of the Owner's pre-occupancy transition training.
   2. Provide one (1) eight-hour session at a time set by the Owner for maintenance training of the system.

C. Provide an interactive training DVD's for all system operations and system troubleshooting. Provide system operations and system troubleshooting training on separate DVD's. Provide two copies of each.
   1. This DVD shall be carefully organized and segmented so that training may be given on the complete system or on specific functions as may be appropriate.
   2. The DVD shall contain computer-generated screen animation with narration describing icon selection, graphic animation and operation.
   3. The maintenance portion of this DVD shall contain still images with graphics and narration describing all equipment states and troubleshooting methods including LED indication and text read out.

1.5 SUBMITTALS

A. The SCSC shall submit four (4) submittals for this project. Each submittal shall contain all the necessary criteria for all Div. 285xxx sections, and for each subsequent re-submittal if necessary. Submittals 1 (Product Data) and 2 (Shop Drawings) shall be submitted at the same time. Following this process will afford the submitted information to be reviewed more efficiently. All the necessary information the reviewer needs to properly evaluate the submission will be in the package each and every time it has to be reviewed. Failure to follow these submission re-

quirements shall constitute the submittal(s) as being non-compliant and will be returned as "Rejected/Resubmit".

B. It shall be the responsibility of the Architect and OWNER to completely review and approve all details of the VGUI control console screens prior to release for final software production. Any applicable changes made prior to release for software production shall be made at no cost to the Owner. (Refer to Part 3 - Execution, paragraph 'Software Supports'.)

C. The submittal packages shall consist of one (1) reproducible (digital format) copy for each of the four (4) submittal types listed below. Each of the submittal types listed below shall include information from all the Div. 285XXX sections, as stated in paragraph A above. Provide electronic bookmarks, hyperlinks and divider pages to help navigate to and within the documents. Bookmarks and divisions shall match what is provided in the submittal's table of contents.

1. Product Data:
   a. Provide Title Page and Table of Contents. Organize document by spec sections as listed in the Project Manual. Provide electronic bookmarks and divider pages to allow reviewer to navigate to spec sections and the different items within each section.
   b. A Bill of Materials for each system, which shall include manufacturer names, model numbers, and quantities of all equipment proposed. It is acceptable to combine the Bill of Materials with the Table of Contents or section headings, provided all the required information is provided.
   c. Technical product information clearly marked to identify the principal component(s) proposed. Information shall be listed in same order as presented in Table of Contents.
   d. Specifications information for each type of cable required (power and data) and its application.
   e. Markings: Submit for approval the SCSC's proposed wire marking, panel label, zone label, terminal strip numbering & terminal strip identification styles and typical text as outlined.
   f. Shall be submitted at same time as Shop Drawings Submittal.
2. Shop Drawings:
   a. All drawings shall be computer-generated for expedient modifications if required. At completion of the project, these drawings, along with any field changes, shall become part of the Contract Documents. Refer to paragraph titled "Record Drawings" ahead.
   b. Building Floor Plan / Device Layout drawings: These drawings shall indicate the accurate locations of all equipment associated with each system in respect to architectural and structural conditions. Size drawings of components, equipment layouts and other small size areas to the common scale of 1/8", 1/2" or 1" per foot. Size drawings of larger areas to the common scale of 1/4" or 1/8" per foot. Drawings shall include explicit notes on the termination of all conductors and shields for each location. Architectural backgrounds shall be in accordance with the latest architectural drawings and shall be complete with elevations, sections, and details as required to depict the installation. These drawings shall be approved prior to starting work.
   c. Equipment Room Layout Floor Plans:
      1) Scaled plan drawings indicating the placement of all required security control system components/racks and their relationship with all other adjacent objects.

2) Indicate clearance and maintenance access requirements, and confirm all necessary clearances around components for both installation and maintenance have been coordinated.
3) Dimension the location of and provide installation details of the security control system's 'Head-End' racks, including mounting and anchorage provisions.
4) Provide elevations of each rack indicating the location of all equipment and components.

d. Control Room Enlarged Floor Plans and Elevations: Provide detail drawings depicting the plan location and elevation of all equipment to be provided within each security control room.
e. Block Diagrams:
1) Provide block diagrams of all systems/sub-systems showing interconnects and relationships as a complete system.
2) Describe all power requirements and connections. Indicate line and low voltage information, all UPS, battery back-up, and emergency/generator power.
f. Provide complete "point to point" wiring diagrams for all systems and subsystems. Indicate all components in the communications path from Central Control through all intervening system components, including terminal boards to the individual end devices. Document dedicated leased lines and associated equipment required to complete a transmission path. Where conductors are grouped into a cable for long site runs, a single line properly identified shall be indicated. Where these cables fan out for termination, individual wire terminations and markings shall be indicated.
g. Wire management details for the installation of cable harnesses inside racks, equipment cabinets, and consoles, control panels and other areas of exposed cable.
h. Shall be submitted at the same time as the Product Data Submittal.

3. Test Procedure:
a. Provide written document detailing the test procedure for substantial completion of the system provided. These procedures shall include all tests recommended by the equipment manufacturer and by this specification.
b. Provide samples of system approval test sheets for review.

4. Screen Shots:
a. VGUI Control Console "Screens": Submit for approval a detail drawing or screen snap shot of each control console "screen" depicting the exact layout to full size scale. Screens that distort the building floor plan layout are not acceptable. Representation of all colors shall be included, as well as the operator's orientation of the control panel in relationship to the control room and building.
b. Include a glossary of all icons available and a description of their function and actions shown beside an image of each of their varying states of status.
c. The review and approval of this submittal will only serve as a basis for proceeding forward with Phase I meeting of Software Support as described in paragraph 3.3.A. A second Screen Shot submittal shall be provided after the Phase I meeting to reflect any decisions made during that process.

1.6 TESTING

A. The Security Control System shall be assembled and tested at the SCSC's shop. Refer to paragraph 3.3.B for Phase II expectations and requirements.

B. Submit approved substantial completion test sheets seven (7) days prior to scheduled testing date.

C. Conduct with Owner and/or Architect a comprehensive system test of all system components per the approved test plan. At completion of all testing, provide substantial completion test sheets.

1.7 RECORD DRAWINGS

A. The SCSC shall obtain, pay for, and keep up-to-date and available to the Owner or its representative, complete black-line prints as well as magnetic media copies of all computer drawings of the project, clearly annotated with "as-built" data as the work is performed. This data shall include the following:

1. Routing of conduit and raceway.
2. Routing of signal and power wire and cables, including the designations assigned to each wire/cable and field terminations schedules.
3. Accurate location of all equipment installed under the specifications.
4. A complete equipment list for each functional area.

B. Upon completion and for inclusion into the Final Record Sets of drawings of this project, all as-built information shall be transferred to a full size set of AutoCAD drawings and transmitted to the A/E within 30 days of substantial completion.

1.8 GUARANTEE

A. The SCSC shall guarantee all equipment & systems for a period of two (2) years commencing with Substantial Completion. The guarantee shall cover all costs for Warranty Services, including parts, labor, prompt field service, pick-up and transportation.

B. The SCSC shall also provide an extended warranty for computer hardware that includes critical maintenance support services for a period of five (5) years commencing with Substantial Completion. Critical support services shall be available 24 hours per day, 365 days per year, with 4 hour onsite response time.

C. The Owner shall be listed and registered as the owner of all SCSC provided equipment and software no later than the completion of the contractual warranty period.

1.9 WARRANTY AND PREVENTATIVE MAINTENANCE SERVICES

A. The SCSC shall design the Security Control System to provide for remote PC connection with the new security control system. This remote connection shall be used by the SCSC during the warranty period for remote system troubleshooting and maintenance. The Owner/user will activate and de-activate the local communications device to ensure that unauthorized remote access to the security control system will not occur.

B. Maintenance services within this scope of work shall include a preventative maintenance and system optimization inspection to be conducted every three (3) months during the first year of warranty. These visits shall be recorded at the site by signing in the Owner's daily operations log book and shall include, as a minimum, the following:

1. Configuration Checks on video recorders

2. Verify the integrity of all system software including Remote Viewing Stations.
3. Configuration Checks on Access Control System Components and Software.
4. Cleaning of air filters.
5. Adjustment of video monitors picture controls.
6. Tuning of video camera views (i.e., focus, iris).
7. Configuration and through-put tests of system network (i.e., network switches)
8. Inspection of cables and connections.
9. Inspect and test all UPS units, including batteries and cables.

C. Service response requirements shall include the following:
1. Twenty-four (24) hour phone number to reach in-house troubleshooting personnel.
2. Ability to restore functionality within eight (8) hours after notification on a twenty-four (24) hour basis.
3. Service technicians trained by the manufacturers of the system components.
4. Provide remote support within a four hour response time during regular business hours - 7am – 6pm, Monday – Friday, excluding holidays.

PART 2 - PRODUCTS

2.1 Refer to appropriate Division 28 section for specific product information.

PART 3 - EXECUTION

3.1 INSPECTION

A. Check location, "roughing in", and field dimensions prior to beginning work.

B. Do not begin installation until all unsatisfactory conditions have been corrected.

C. Verify field measurements are as indicated on Drawings and as instructed by manufacturer.

D. Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION/APPLICATION OF ALL SECURITY PRODUCTS

A. Field testing and inspection will be performed under the provisions of Section 285000.

B. Replace equipment, components, & wiring as required to achieve a fully functional system.

3.3 SOFTWARE SUPPORT

A. PHASE I
1. Within three (3) months of receiving the approved shop drawing submittal, the SCSC shall request in writing a preliminary meeting with the Owner/Architect to discuss and demonstrate his working VGUI, programmed 'In-House' for the specific operations and functions of this project's Security Control System. Also the SCSC shall present an extensive outlined analysis of all his 'In-House' software's performance possibilities and their potential applications and/or approval to be utilized on this project. Refer to para-

graph 1.5.C.4 of this section for the 'VGUI Screens' shop drawing submittal requirements.

2. The SCSC shall prepare a detailed report summarizing all software design and function criteria to be submitted to the Owner/Architect for approval by appropriate parties no later than two weeks after the date of the Phase I meeting. The custom software that operates the security control system shall be designed specifically from this document.
3. The Phase I meeting shall outline the requirements of the custom software as it relates to integrating all the individual components and devices making up the Security Control System (VGUI, VMS, Intercommunications, Alarms, Locks, etc.)

B. PHASE II

1. Prior to the scheduled date for job site delivery of the VGUI control stations, the SCSC shall request a second meeting with the Owner/User and Architect/Engineer at their manufacturing facility. The SCSC shall provide a full demonstration of the completed control consoles with a fully functional simulation of all the security control system software. The design and function of the 'In-House' software shall match the exact performance as specified in the detailed Phase I report. The SCSC shall include in their bid all expenses (travel, per diem, hotel and food) for four (4) owner representatives and two (2) architect representatives to attend the factory testing of the systems for a two (2) day period.
2. All deviations in the performance of the hardware or software shall be documented during this meeting, by the Architect/Engineer and SCSC, on a "pre–punch list". This "pre-punch list" shall be 100% corrected by the SCSC prior to delivering the equipment to the job site. Any additional comments shall now be incorporated.
3. During this time period, the SCSC shall perform all tests and critical conditioning on the security system to prepare the detailed diagnostic information and operational procedures for the service/operations manual.

C. PHASE III

1. Immediately following the installation of the security control system, the SCSC shall work with the Owner, the facility personnel, and the Architect/Engineer to correct any hardware problems or operational deviations from the original Phase I software design document. The SCSC shall modify the hardware/software as necessary to solve any problem resulting from poor installation.
2. Upon achieving a 100% functional security control system as determined by the Architect/Engineer, a documented release form provided by the SCSC shall be signed by the Owner and retained on file with the Project Manager. The SCSC shall continue to work on the installed hardware/software at no cost to the Owner or Architect/Engineer until the Owner's satisfaction is obtained by fulfilling the Phase I, II, and III document and a system release form is filed.

3.4 SPARES FOR ALL SECURITY CONTROL SYSTEM SECTIONS

A. Each system provided by SCSC shall be built with the space, capacity, headend equipment and licenses to expand by 15 percent above those indicated for work of this project.

B. Provide the following shelf spares:

1. Provide one (1) PLC of each type used.

2. Provide one (1) PLC input and one (1) PLC output module of each type used
3. Provide one (1) PLC system power supply
4. Provide one (1) Power supply of each type used
5. Provide one (1) Duress station of each type used
6. Provide one (1) Card reader and one (1) Keypad/Card Reader of each type used
7. Provide one (1) Intercom station and one (1) Intercom master station
8. Provide one (1) Speaker (ceiling mount) with baffle and one (1) wall mount Speaker
9. Provide two (2) pre-programmed Fixed cameras and one (1) pre-programmed Multi-lens and PTZ camera with licenses of each type used.
10. Provide one (1) 24" VMS video monitor.
11. Provide one (1) 24" VGUI station with PC fully loaded with software for plug-and-play operation when an officer station VGUI/computer goes down.
12. Provide ten (10) relays, terminals, and fuses of each type used.
13. Provide one (1) spare of each type of surge protector.
14. Provide one (1) spare Glass Break sensor of each type used.
15. Provide two (2) hard drives of type installed on this project for video archive storage.

END OF SECTION 285000

SECTION 285010 – PLC, NETWORK, AND UPS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 DESCRIPTION OF WORK

A. The security control system shall be comprised of one or more programmable logic controllers and operator interfaces. The system shall include but not limited to, remote I/O, power supplies, input modules, output modules and any other required equipment to provide a fully functional system. The system will receive discrete inputs, and through the use of an internal control logic program, control output relay operations and perform remote control functions via the video graphic user interfaces.

B. Provide labor, equipment, materials and supervision to install, program, calibrate, adjust, document, and test the total system as required herein, as shown on the drawings and required for the complete integration of the security system.

1.3 CONTROL, MONITORING, AND ANNUNCIATION

A. The security control system shall control all electrically operated door hardware, monitor all doors position and bolt position limit switches, annunciate all door status and alarms. Lighting and receptacle control, intercommunication, paging, duress and video management control shall be integrated into the security control system. As part of video graphic user interface system, provide an integral security management system that shall record to disk, all occurrences of the system. Provide video graphic user interface terminals and security management system computers at locations as requested in the contract documents.

B. The PLC System provides the logic control for the Security Control System. Unless noted otherwise, all user-initiated interfaces to the PLC system is performed through the Video Graphic User Interface (reference Section 285020). Critical control functions, such as door control and duress are to be executed by the PLC CPU program(s).

PART 2 - PRODUCTS

2.1 PROGRAMMABLE LOGIC CONTROLLER (PLC) SYSTEM

A. General requirements

1. Provide a Programmable Logic Controller (PLC) system that utilizes logic functions, memory, timing functions, software, I/O points, and communication capabilities for the control and/or monitoring functions of the systems described and shown in the contract documents.
2. Each PLC shall be password protected against unauthorized entry to software.
3. All components of the PLC system shall be by the same manufacturer, no mixing of multiple manufacturers shall be considered.
4. Provide only UL Listed components.

5. Provide a PLC System that seamlessly integrates the control system to the Local Area Network Hubs.
6. Provide CPU(s) with a visual status indication of backup battery.
7. Provide alarm in the event of CPU low battery voltage before battery failure.
8. Provide 15% spare PLC system capacity at the completion of the project. This includes program memory, I/O memory allocation, register memory, user memory, etc.
9. Provide programming that utilizes a simplistic logic format that can easily be modified by 3rd party vendors.
10. Provide 15% spare PLC I/O module capacity at the completion of the project. Calculate inputs and outputs separately when figuring capacities.
11. All PLC interposing relays must be fused to protect the relay and field device wiring from over-current caused by shorts or device failure.
    a. Exception: Whereas the terminal block is in receipt of a dry contact from another system, a fuse isn't required on that portion of wiring.
12. PLC Central Processor Unit
    a. Provide expansion chassis and power supply module with each processor assembly as needed.
13. PLC Digital Inputs and Outputs
    a. Each input or output module shall be a self-contained unit.
    b. It shall be possible to replace any I/O module without disturbing or removing user field wiring.
14. PLC Remote Inputs and Outputs
    a. The remote I/O system shall be compatible with all of the modular I/O systems.
    b. Power will be provided by the I/O rack assembly power supply.
15. Termination Labeling
    a. Each wire will be labeled with an industry standard thermal transfer wire marker.
    b. I/O wire number should reference wiring diagram and Software I/O list.
    c. Felt tip pen labels are unacceptable.
16. The control architecture will use distributed control over the Ethernet network.
17. Local and remote networking shall be via dedicated interface modules providing serial communications at rates, which are selectable from 62.5K to 1M, bits per second. The interface modules shall be capable of I/O drops at distances of up to 7,500 feet and control up to 32 remotes.
18. The PLC shall have a communications card capable of communicating with an industry standard stand-alone computer.
19. Communication between the PLC and the computer(s) shall be a peer to peer network; no master station (central hub or server) shall be required.
20. Communication on the peer to peer network shall be a minimum of 50 K baud of data transmission.
21. There shall be no noticeable delay between any video graphic user interface icon or field device input and the resulting output on the video graphic user interface or in the field.
22. Door Monitoring and Control: Lock position and door position switches shall be wired as separate inputs to the PLC. The deadbolt switch will be wired as a separate input to the PLC as well as the door position switch a separate input to the PLC. When the door is locked and secure, the circuits shall provide voltage to the PLC. If the door is a sliding

door or overhead door, then the open and close limit switch will be wired as separate inputs to the PLC and will not be part of the sliding or overhead door control circuits.

a. Unless otherwise stated, all electrically controlled and/or monitored doors shall be connected and controlled and monitored by the PLC System.
b. All electric locks shall be individually fused. Provide door control relays with indication light.
c. Locks shall be controlled via mechanical interposing relays driven by the PLC. Solid-state relays are not acceptable. Provide all required power to control doors.
d. Interlocks shall be implemented via PLC software. Any door shall have the ability to be programmed to become a member of an interlock scheme. The Architect and/or owner shall reserve the right to re-define interlocks during the submittal phase without additional costs to the owner.
e. Upon a loss of power, faults or communication failures with PLC input and output modules or PLC CPUs, all electric locks shall de-energize (fail-secure). Sliding and overhead doors shall remain in their present state.

B. PLC Specifications:

1. PLC Central Processor Units
   a. Processor to serve up to 2048 I/O points or more
   b. Minimum 64K word instruction memory
   c. RS-232 ASCII configurable auxiliary com port
   d. Bit instruction execution time of 0.80μs max
   e. Built in real time clock and calendar
   f. Built in 100Mb or Gigabit Ethernet port
   g. Battery backed EEPROM memory
   h. Connectivity via Ethernet, Devicenet, Modbus RTU master/slave over RS-485 and RS-232-C.
   i. Shock rating, operating – 30.0g (3 pulses, 11 ms)
   j. Vibration rating – 1.0g @ 5-2000 Hz
   k. Operating Temperature range – 32 to 140 Degrees F
   l. Operating Humidity range 5 – 95% RH non-condensing
2. PLC Digital DC Input Modules
   a. 10 – 30 VDC operating range
   b. Sourcing or Sinking type modules
   c. Maximum on/off signal 0.5mS max with selectable 1 or 7mS filter
   d. Maximum off state current 0.5mA
   e. 32 point modules minimum
   f. Maximum backplane current load – 50mA
3. PLC Digital DC Output Modules
   a. 10.2 - 30 VDC operating range
   b. Sourcing or Sinking type modules
   c. Maximum continuous current per output, .5 amp sourcing/1.0 amp sinking
   d. Maximum continuous current per module, 8 amp sinking or sourcing @ 60° C
   e. 32 point modules minimum
   f. Maximum backplane current load – 90mA @ 5 VDC
   g. Removable terminal blocks
   h. Gold plated contacts
4. PLC Power Supplies
   a. 120/220 VAC nominal input voltage

b. Maximum input power, 27 VA
c. Backplane output current, 1.5 amps total
d. Operating Temperature range – 0 to 60° C
e. Operating Humidity range 5 – 95% RH non-condensing

5. Acceptable Manufacturer
   a. Allen Bradley
   b. G.E. Fanuc
   c. Omron
   d. MTI
   e. Or Approved Equal

2.2 LINEAR POWER SUPPLY

A. Provide linear power supplies as required for control power.

1. Specification
   a. AC Input: 120 VAC, +10%, -13%
   b. DC Output: 24 VDC (5A or 10A as required)
   c. Line Regulation: +/-.05% for a 10% change
   d. Load Regulation: +/- .05% for a 50% load change
   e. Output Ripple: 3 mV peak-to-peak maximum.
   f. Transient Response: 50 microseconds for 50% load change.
   g. Short Circuit Protection: Automatic current limit/fold back
2. Provide back plates, mounting hardware and all appurtenances required to install the power supplies in the system equipment racks.
3. An individual homerun cable is required to each field device from the power supply. Do not loop-wire or daisy-chain power, or tap power conductors from a junction box. Device power will be part of the control wiring to the device
   a. Exception: 120 volt continuous power wiring, such as exterior camera power
4. The output of the power supply is to feed a series of fuses rated for the intended load. One each per homerun cable/device load
5. Acceptable Manufacturer
   a. Phoenix Quint-series
   b. Sola
   c. Power One
   d. Or Approved Equal

2.3 RELAYS AND TERMINALS

A. Relays - General

1. The relays shall provide actual switching of power to electric locking hardware, lights, etc.
2. All relays shall be of electro-mechanical type and be standard off-the-shelf commercially available components.
3. Relays and terminals for each device shall be grouped together, and each terminal shall be labeled.
4. Relays shall be pluggable with diode protection across coils and LED indication of activated coil circuit.
5. Each relay contact to the control device shall be individually fused.

6. Low voltage wiring in relay cabinet shall be separated from high voltage wiring and all wiring shall be color-coded and marked with approved wire markers.
7. Control wiring shall be routed through plastic wire duct and landed on terminal strips.
8. Relays shall be controlled directly by the PLC.
9. Peripheral interface cards with active circuitry will not be approved.
10. SPST or DPDT as required. The relays will perform the actual switching of the power to the locks. Electric locks shall not be controlled directly by the PLC.
11. Acceptable Manufacturers:
    a. Idec
    b. Potter and Brumfield
    c. Phoenix Contact
    d. MTI
    e. Or Approved Equal

B. General Purpose Relays
1. Specifications
    a. Switching Capacity: 6 Amp continuous, 8 Amp inrush.
    b. Duty cycle: 100%
    c. Termination: Screw Connection
    d. Operating Indicator Light, Damping diode, polarity protection diode
    e. Operating Voltage: 24 VDC
    f. Temperature: -20 C to 55 C
    g. DIN Rail Mountable Socket

C. Special Purpose Relays (High Power)
1. Specifications:
    a. Relays contacts shall be U.L. listed for a continuous current of 10 amps (inrush of 16 amps)
    b. Termination: Screw compression
    c. Operating Indicator Light
    d. Coil Rated Current: < 70 ma
    e. Operating Voltage 24 VDC
    f. Max. Cont. Applied Volt: 110%
    g. Drop-out Voltage: 10%
    h. DIN Rail Mountable Socket

D. Fuses Terminal Blocks
1. Specifications
    a. Din Rail mountable IEC style (if external from Relay boards)
    b. Should be dead front safety (ie. touch safe)
    c. Screw clamp and Spring Clamp are acceptable
    d. All Fuse terminal blocks will be sized accordingly to the wire gauge and current load required for the application.
    e. Provide lever disconnect type IEC fuse blocks.
2. Acceptable Manufacturer
    a. Allen Bradley
    b. Phoenix Contact
    c. Square D
    d. Or Approved Equal

E. Modular Terminal Blocks

1. Specifications
   a. Din Rail mountable IEC style (where external terminal blocks are needed)
   b. Dead front safety (ie. touch safe)
   c. Screw clamp and Spring Clamp type acceptable
   d. All terminal blocks will be sized accordingly to the wire gauge and currents load required for the application.
   e. Safety grounds should be identified with yellow/green color.
   f. One wire per termination point unless Ferrules are used for special applications
   g. All ferrules are to be crimped using the manufacturer's recommended crimping tool.
2. Acceptable Manufacturer
   a. Allen Bradley
   b. Phoenix Contact
   c. Square D
   d. Or Approved Equal

F. I/O Boards

1. Input boards shall be optically isolated and designed to accept an input signal of 24 volts AC or DC. These boards shall be capable of rack mounted. Each input point shall have a corresponding LED indicator which illuminates when the input is read as on by the microprocessor. These boards shall be configured in a minimum of 16 inputs.
2. Output boards shall be reed relay outputs with ability of isolated commons. These devices shall be capable of rack mounted. Each output shall be fused and be accompanied by a LED indicator which illuminates when the processor issues a command to energize the output, and a second LED to indicate the condition of the fuse. These boards shall be configured in a minimum of 16 outputs.
3. Boards combining inputs and outputs on the same board will be acceptable provided they meet the requirements listed above.

2.4 SECURITY LOCAL AREA NETWORK

A. Provide an independent secure Local Area Network (LAN) that shall include connections between the PLC system, graphic user interfaces, intercommunications/audio system, video management system, card access, and other integration system CPUs.

B. The LAN shall be a high speed, fault tolerant, self healing Ethernet industrial communication network. It shall be a tree topology using fiber optic media as required and be in compliance with IEEE 802.3.

C. The Ethernet Network shall consist of CAT6 UTP cable within the structure for distances less than 100m.

D. Ethernet UTP shall be run without splice unless terminated through the appropriate patch using RJ-45 connectors or approved punch down blocks.

E. Fiber Optic shall be used:

1. For the network backbone
2. Between structures
3. Any application beyond the building walls (exterior)

4. Distances over 100m

F. Network Fiber Optic transceivers shall be integral to the network scheme, utilizing SFP or mini-GBIC technology for the network backbone between switches. Separate converters will not be allowed for Ethernet backbone.
   1. Fiber Optic connectors shall conform to the device served without the use of adapters.
   2. Terminate all unused fibers in a patch panel using correct and consistent labeling at both ends.

2.5 NETWORK SWITCHES

A. Provide switches for the IEEE802.3a-f 10/100/1000 BASE-T Local Area Network connectivity and 1 Gigabit minimum uplink capability. Provide stackable switches for faster uplink speeds.
   1. 24 RJ-45 ports minimum (Switches shall be sized as required)
   2. Auto crossing, auto negotiation
   3. LEDS: Link Integrity and Status, Link speed, RPS, PoE
   4. PoE (power over Ethernet) capable, with up to 30W per port
   5. 370W or 740W fixed power supply option
   6. Operating Temp -5°C – 45°C
   7. 100 – 240 VAC, 50 to 60Hz, 5A max
   8. 19" Rack Mountable

B. Acceptable Manufacturers
   1. Cisco
   2. HP
   3. Approved Equal

2.6 UNINTERRUPTIBLE POWER SUPPLIES (UPS)

A. This section defines the electrical and mechanical characteristics and requirements for a continuous-duty single-phase, solid-state, uninterruptible power system. The UPS will provide high-quality AC power for sensitive electronic equipment loads.

B. Ratings
   1. 120 Volt Nominal Units, Single Phase
   2. UL Standard 1778
   3. NEMA Type 1 Enclosure
   4. FCC Part 15, Class A

C. The SCSC shall supply UPS power at each Security Electronics room, sized to provide adequate and protected power for the loads served.

D. Submit a list of loads showing the ratings (amps, watts, volts) and the time-wattage charts for the UPS. The list shall include a side bar showing the BTU-hr heating effects of the equipment in the control rooms and equipment room. Include the BTU-hr heating effects of the selected UPS.

E. Provide the size and quantity of UPS units required to support the attached load to be served plus an additional 20% headroom.

F. Provide a UPS at each rack, cabinet and VGUI. The UPS shall have sufficient battery capacity and charging capacity to operate all security system equipment (to include VGUI(s), SMS, PLC system, all door monitoring, audio system, camera system and digital video recording system) for a period of 5 minutes at full load without degradation to the system. Only rack mounted UPS systems may be used in equipment rack or console locations.

G. Devices with built in battery backup such as door lock power supplies or card access panels do not require a separate UPS. UPS or battery power is not required for door lock power supplies.

H. The UPS system shall interface with the PLC System providing indication of "UPS trouble" status of the unit(s). Provide interface to Central Control to monitor both alarm and trouble signals from each UPS.

I. Where the total number of circuits required for UPS-fed apparatus from any individual UPS unit that feeds a main or remote rack exceeds six circuits, the SCSC shall furnish and install a minimum of a 100 ampere main-breaker panelboard.

1. The panelboard shall be rated for the required load, but at a minimum it shall be 100A bus with 60A Main Breaker, 120/240V, 10K AIC, single phase, three wire, with ground bus, and furnished with a minimum of (8) one-pole 15 or 20 amp bolt-in circuit breakers installed.

J. All UPS branch circuitry, inclusive of the main distribution panelboard, must be installed by a licensed electrical contractor with journeyman electricians in attendance. If requested, the SCSC must provide proof of expertise.

K. The UPS is designed to operate as a true on-line double conversion system in the following modes:

1. Normal - During normal operation, utility power provides energy to the UPS. The filters, the power factor correction circuit and the inverter process this power to provide computer-grade power to connected loads. The UPS maintains the batteries in a fully charged state.
2. Battery - The UPS will enter Battery mode if there is an extreme power surge, extreme power drop, or utility failure. The battery system supplies power through the DC-to-DC converter to the inverter to generate computer-grade power for the connected load.
3. Recharge - Once utility power is restored, the UPS resumes normal operation and the Battery Charger begins recharging the battery.
4. Bypass - Bypass mode provides an alternate path for utility power to the connected load in the unlikely event of a UPS malfunction, such as overload, overtemperature, or an internal circuit failure.
5. Automatic Restart - Upon restoration of utility / mains AC power, after a utility mains AC power outage and complete battery discharge, the UPS automatically restarts and resumes supplying power to the critical load and the battery charger automatically recharges the battery.

L. Design Requirements

1. Voltage: Will operate at either 120/208V or 120/240V by sensing the utility phase angle and configuring the dual inverters to the same angle: 120 or 240 degrees, (or) 180 degrees. Coordinate power requirements with EC during submittal phase.
2. Nominal input/output voltage specifications of the UPS at rated load are:
   a. The UPS will operate on voltage ranging from 120/208V, 60/50 Hz, (or) 120/240V, 60/50 Hz without the use of selector switches or voltage taps. Input

wiring must be 3-wire (L1, L2, N) -plus-ground. The output voltage is automatically set to match input voltage.

3. Output Load Capacity: Specified output load capacity of the UPS is:
   a. 6000 VA/4200Watts at 0.70 power factor for 120/208V and 127/220V with all L-N loads
   b. 5200 VA/4200 Watts at 0.81 power factor for 120/208V and 127/220V with all L-L loads.
4. Internal Battery: Valve regulated, non-spillable, lead acid cells.
5. Reserve Time: 4200W minimum 5 minutes with ambient temperature of 77°F (25°C).
6. Battery Recharge: The UPS contains a battery recharge rate designed to prolong battery life. Recharge time for UPS internal batteries is six (6) hours maximum to 90% capacity after a complete discharge into full load.
7. Input Line Transient Immunity: The UPS withstands input line transients in compliance with IEEE c62.41, Category A and
8. Surge Protection: The UPS utilizes MOV ratings will be 175 Volt, 150 Joules minimum connected L1-N and L2-N; 300 Volt, 150 Joules minimum connected L1-G, L2-G and N-G
9. Battery Mode Neutral Grounding: UL1778 requires each input pole to be disconnected from the source during battery operation. The patented design of the UPS includes a relay to bond the output Neutral to Ground during battery mode operation to prevent a floating output neutral during battery mode operation.

M. Environmental Conditions
   1. Ambient Temperature: + 32°F to + 104°F (0°C to +40°C) for altitudes 0 to 5,000 feet (0 to 1500 meters) above sea level. + 77°F (25°C) for optimum battery performance.
   2. Relative Humidity: 0 to 95% non-condensing.
   3. Storage: 0 to 95% non-condensing.
   4. Audible Noise: Noise generated by the UPS under normal operation does not exceed 55dBA when measured at 1 meter from the surface of the UPS.
   5. Electrostatic Discharge: The UPS is able to withstand an electrostatic discharge compliant to EN61000-4-2, level 4, Criteria A, without damage and will not affect the connected load.

N. The UPS unit is comprised of the input PFC converter, battery charger, dual-inverter, input filter, automatic bypass circuit, housed in a rack - tower NEMA type 1 enclosure

O. The UPS shall meet the requirements of IP20.

P. The UPS is forced air cooled by internally mounted continuous fans. Fan power is provided from the internal DC supply. Air intake is through the front of the unit and exhausted out the rear of the unit.

Q. Converter: Incoming AC power is converted to a regulated DC output by the input converter for supplying DC power to the inverter. The input converter provides input power factor correction (PFC) and input current distortion reduction.

R. AC Input Current Limit: The input will use whatever power is needed to power the output overload specification before going to batteries. The UPS does not use electronic input current limiting. The UPS includes a 2-pole switch-type 30A input breaker.

S. Input Protection: The UPS has built-in protection against undervoltage, overcurrent, and over-voltage conditions including low-energy lightning surges, introduced on the primary AC source. The 208 VAC models can sustain input surges without damage per criteria listed in ANSI C62.41 Cat. A & B.

T. Battery Recharge: The UPS contains a battery recharge rate designed to prolong battery life. The battery is constant current charged to restore capacity, then shall be constant voltage charged to maintain the battery in a fully charged state. Recharge time for the internal battery shall be six (6) hours maximum to 90% capacity (full load discharge rate). There is DC over-voltage protection so that if the DC voltage exceeds the pre-set limit, the inverter will shut-down automatically and the critical load will be transferred to bypass.

U. Other General Features:

1. The UPS inverters are a pulse-width-modulated (PWM), IGBT design capable of providing the specified AC output. The inverters convert DC power from the input rectifier output, or the battery, into precise sinewave AC power for supporting the critical AC load.
2. Overload: The inverter is capable of supplying current and voltage for overloads exceeding 100% and up to 201% of full load current. A visual indicator and audible alarm indicates overload operation. For greater currents or longer time duration, the inverter has electronic current-limiting protection to prevent damage to components. The inverter is self-protecting against any magnitude of connected output overload. Inverter control logic senses and disconnects the inverter from the critical AC load without the requirement to clear protective devices.
3. Inverter DC Protection: The inverter is protected by the following DC shutdown levels:
    a. DC Overvoltage Shutdown
    b. DC Undervoltage Shutdown (End of Discharge)
4. Output Frequency: An oscillator controls the output frequency of the UPS. The inverter maintains the output frequency to + 0.1 Hz of nominal frequency during battery mode, frequency converter mode, or when otherwise not synchronized to the utility/mains source.
5. Output Protection: The UPS inverter employs electronic current limiting circuitry for protection during normal mode and battery operation, and input circuit breaker protection during bypass mode operation.

V. Display and Controls

1. General: The UPS is provided with a microprocessor-based control and a status display section designed for convenient and reliable user operation. The monitoring functions such as status and alarm indicators are displayed on a front-panel LED display.
2. System Indicators: The UPS includes five individual LED status indicators, and three rows of LED's to indicate UPS load and battery capacity. An audible alarm will be used in conjunction with the visual indicators to indicate to the operator a change in UPS operating status.
3. All audible alarms can be silenced, with the exception of low battery, bypass reminder, and missing batteries at startup alarms. Once silenced, the audible alarm will not sound until a new alarm condition is present. Standard LED indicators are described below:
    a. Load Level indicators – 10 total: 4 green and 1 amber, for each of the L1 and L2 outputs. The Load Level indicators display the approximate load level at all times.

b. Battery Capacity indicators - 5 green LEDs. The Battery Capacity LEDs display the approximate level of battery reserves.
c. Fault indicator - 1 red LED. The Fault indicator LED illuminates if the UPS detects an internal problem. One or more of the Battery Capacity indicators may be illuminated to aid in diagnostics.
d. AC Input indicator - 1 green LED. The AC Input indicator LED is illuminated when utility power is available and falls within the input specification.
e. UPS ON indicator - 1 green LED. The On Inverter indicator LED is illuminated when the UPS inverter is operating and supplying power to connected loads.
f. On Bypass indicator - 1 amber LED. The On Bypass indicator LED is illuminated when the bypass source is supplying power to connected loads.
g. On Battery indicator - 1 amber LED. The On Battery indicator LED is illuminated when the AC Input is out of the acceptable operating range.

4. On-Standby-Off Controls: UPS start-up and shutdown operations are accomplished by the "ON" and "STANDBY" push buttons located on the front panel of the UPS. The "ON" push button is a means to turn the UPS on and also serve as a means to manually test the battery. The "STANDBY" push button allows manual transfers of the load from the inverter to bypass power. Pressing the "STANDBY" push button, in bypass mode or battery mode, will completely shut down the UPS and its connected load.
5. On-Line Battery Test: The UPS features an automatic battery test with the factory default test interval set at every 2 weeks. The battery test will ensure the capability of the battery to supply power to the inverter while loaded. If the battery fails the test, the UPS will display a warning alarm to indicate the internal batteries need replaced and resume operation without disturbing the load. The battery test feature is user accessible by the push button located on the front of the unit.

W. Bypass

1. General: A bypass circuit is provided as an integral part of the UPS. The bypass shall have a make-before-break transfer, will have a maximum detect and transfer time of 4-6 milliseconds, and be a double-pole device. The bypass circuit is designed to ensure the simultaneous transfer of the L1 and L2 poles.
2. The bypass is configured to wrap around the PFC converter, battery charger, DC-DC converter, inverter, and battery. The bypass circuit will use the rear-panel mounted UPS input circuit breaker and route bypass power through the UPS input filters and surge suppression circuit. The bypass circuit default position is in the bypass mode (utility).
3. Automatic Transfers: The transfer control logic automatically activates the bypass, transferring the critical AC load to the bypass source, after the transfer logic senses one of the following conditions:
   a. UPS overload
   b. UPS over temperature
   c. PFC failure
   d. Inverter failure
   e. DC Bus Overvoltage
4. Once overload condition is reduced, the load is automatically transferred back to inverter power. An over temperature requires manual transfer back to inverter power after cooling.

X. Maintenance Bypass Switch

1. The unit shall be installed on all UPS units over 4KVA.

2. Similar units will be required for rack-mounted UPS units of 1.5KVA and 3KVA
3. The unit allows the ability to take the UPS off-line (transferring to normal power) so the UPS can be serviced.
4. Unit shall be UL1008 listed
5. Manually initiated electrical operation
6. The unit shall have high interrupting ratings, current ratings at 100%, and a solid neutral
7. Pilot lights will indicate NORMAL or BYPASS
8. This external maintenance bypass switch is a MBB (Make Before Break) switch with a locking handle. It must be mounted on the wall near the UPS.

Y. Internal Battery

1. Valve regulated, non-spillable, lead acid cells are used as a stored-energy source for the specified UPS system. The battery kit is internal to the UPS cabinet, and sized to support the inverter at rated load and power factor, with ambient temperature of 77°F (25°C) for a minimum of 5 minutes reserve time. The expected life of the battery shall be 3 - 5 years or a minimum 250 complete discharge cycles at ambient temperature of 77°F (25°C). To promote battery service life and eliminate over-discharge of the battery, the end-of-discharge DC shutdown voltage will be automatically adjusted by the microprocessor based upon the percentage load at the onset of battery operation.

Z. Output Distribution

1. Output distribution is integral to the UPS cabinet, and located on the rear of the unit. The output distribution shall provide the capability to re-configure the UPS input and output connections via a removable sheetmetal power distribution box. Distribution options shall be available with break-before-make maintenance bypass switch to allow for complete shutdown and isolation of the UPS for service without powering down the connected loads. Maximum transfer time of the maintenance bypass switch shall be 4-6ms

AA. Communication Options

1. UPS shall have a DB-9 Serial Port (9 pin female) connector on the rear panel to provide UPS status communications. The UPS will communicate via serial communications using Liebert ESP II protocol. The DB9F will also include photo-couplers to signal "on battery" and "low battery" operational status. The UPS will be capable of receiving a signal from the connected host system to initiate a UPS shutdown, when operating from battery power. This signal will be a +5V to +12V level that must remain for at least a 1.6 second duration.

BB. Acceptable Manufacturers

1. Liebert
2. Eaton
3. APC
4. Cyber Power
5. Or Approved Equal

2.7 SURGE/LIGHTNING PROTECTION

A. General

1. All data, power, audio and video signal cables entering the facility from a point exterior to the building shall be equipped with a silicon avalanche diode type of lightning protection.
2. Surge Protection Devices (SPDs) shall be supplied by an ISO 9001:2000 certified company in the business of manufacturing.
3. Product data submittals shall include 8/20µs rated surge capacities, relevant IEEE and IEC specifications, installation instructions, and operating characteristics.
4. Mounting guidelines will be followed as indicated in installation instruction provided by manufacturer.
5. Protector shall be located at the first cabinet through which the cable or conductor passes upon entering the building.
6. The SPD shall be mounted as close as possible to the equipment or service being protected.
7. All wiring points and plug connections shall be "touch safe" with no live voltages that can make contact with a misplaced finger in accordance with IEC 529.
8. The SPDs shall have integral mounting brackets to attach to 35mm DIN rail conforming to DIN EN50022. The mounting bracket of the SPD shall make ground connection to the DIN rail; therefore, minimizing ground impedance connections. The DIN rail and enclosure will be electrically grounded. For installations requiring a high number of SPDs in a single cabinet, a 19" rack mount SPD with provisions for 4 to 24 channels of protection will be acceptable.

B. Surge Protection Devices For 120v AC Power Circuits

1. 120VAC surge protection devices shall be installed on each non-UPS or emergency circuit feeding security devices.
2. The SPD shall be UL listed or recognized to UL 1449, 2nd edition.
3. SPDs for single phase equipment shall be designed to withstand up to a 10kA test current of a 8/20µS waveform according to IEC 1024 Application Guide A and IEEE C62.41.1-2002 Category C area.

C. Surge Protection Devices For Ethernet Data Networks

1. SPDs shall be designed for protection of transmission of Fast Ethernet (100Mbps) over Category 5e cable as a minimum.
2. The protection circuit shall have fine protection diodes between all the signal wires, as well as coarse protection between shield and ground.

D. Acceptable Manufacturers

1. Phoenix Contacts
2. Approved equal

END OF SECTION 285010

SECTION 285020 – VIDEO GRAPHICAL USER INTERFACE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 WORK IN THIS SECTION:

A. This section contains the requirements and operational characteristics for a security control system. The system shall feature video graphical user interface(s) (VGUI) as shown on the plans allowing control for the automated security control system. The Control functions to be initiated by the VGUI include, but are not limited to the following:

1. Door control and monitoring.
2. Interface between intercom stations and speaker output selections.
3. Interface between video surveillance system alarm inputs and monitors.
4. Interface between the control of power circuits for lighting, outlets, and solenoid valves for plumbing.
5. Interface, control and monitoring of card readers, push buttons, and duress stations.

B. System shall also include a Security Management System (SMS) which shall operate as separate terminals as shown on the plans. The system shall provide administrative viewing and retrieval of database information. Data stored within the database shall be stored in Windows-compatible files for exportation and report generation.

1.3 OPERATIONAL DESCRIPTION

A. General Description - The VGUI display shall be divided into three main sections; the Map Display, the Site Map and the Function Control Bar (FCB) on the 24" touch screen(s).

B. The Map Display is the main section on the left of the monitor screen displaying a 2-dimensional view of a selected area in the facility. Each view is referred to as a "Map". The Maps shall have graphic icons representing all monitored and controlled devices placed on the floor plan in their approximate location. The graphics shall optimize the use of screen resolution and color to enhance and simplify the information displayed.

C. The Site Map is the section of the screen that is used to navigate between maps and view the other areas of the facility. The operator shall select an area in the Site Map by clicking on the area with the mouse/touch point. The area will be highlighted in white in the Site Map and be displayed in the Map Display area. The time duration to generate any screen within the VGUI shall not exceed one ½ second. The Site Map area shall have an Intercom Call Pending List Display that shall display all current incoming intercom calls. In order to perform a function, the operator must select an intercom call. Once the intercom is selected the station shall be connected to the intercom master station as well as display the area on the Map Display where the call

was originated. The Site Map area shall also have an Active Call Station Display that will be activated when an operator selects an intercom call.

D. The FCB section of the monitor screen is used to control devices in the facility. Door control functions shall require a two-step operation. The two-step operation is to protect the operator from accidentally opening a door. The operator will select a function Icon in the FCB and then select a Door Icon for a normal door unlock.

E. The FCB shall have a "Utility" Icon. The Utility control is a hidden function on the VGUI screen, therefore, the operator will not see any utility Icons on the Map Display until the Utility Icon in the FCB is selected. Once the Utility Icon is selected the utilities alone will display graphically on the Map display for three seconds. If a Utility Icon on the Map display is not selected within three seconds the command cancels, and the previous Map will be displayed. Activating a utility shall be done by selecting the appropriate Icon on the Display map. When a utility has been selected or turned on, the Icon symbol will change to a yellow color and will stay yellow until it is selected again/turned off.

F. Included in the Central Control operator control panel is a PLC Status Icon that will allow the operator to check the state of all the PLC modules in the facility. The PLC modules shall be grouped by PLC equipment cabinet or rack in black print and will be highlighted in red print if offline.

G. In the event a PLC or PLC module does go offline, a pop up will appear on the screen which will allow the operator to go directly to the PLC status screen.

H. Central Control shall have the ability to view all screens of the facility with status of all doors, and alarm conditions regardless of which VGUI has primary control of those devices. No device or door shall be controlled by two operator stations simultaneously.

I. Icons for doors, intercoms, cameras, etc, which are under primary control of Central Control (i.e. movement doors, exterior doors for sally ports, etc.) shall be displayed as standard icons as described in the sections to follow and can be controlled by Central Control.

J. Icons, which are under primary control of the local VGUI, shall appear on these same Central Control screens as 'sunken' into the screen with a passive or reverse video color. The status of the door position switch (DPS) and lock position switch (LPS) shall be dynamically displayed as described in the sections to follow for both primary and secondary door icons. The intent is to allow Central Control to be aware of door movement in pods, booking areas, etc, while leaving control of those doors with the local VGUI.

K. Local VGUIs shall display icons of doors, intercoms, cameras, etc, which are under primary control of Central and shall appear on these same local VGUI screens as 'sunken' with a passive or reverse video color. The intent is to allow the local VGUI to be aware of door movement in & out of Pod movement doors, booking area's movement doors & exterior sallyports and the vehicular sallyport, etc, while leaving control of those doors to Central Control.

1.4 VIDEO GRAPHIC USER INTERFACE EVENT SUMMARY

A. An event-based strategy shall be applied to the development of the VGUI screens. Color utilized in the screen development shall be neutral gray in nature. Events shall be exceptions to the screen and shall be highlighted both visually using color. Owner shall be able to change color designations at no additional cost.

B. The system shall also incorporate the use of voice announcements and beeps and chimes so that all operator actions, system warnings and emergencies and other important information are announced to the operator. Alarm announcements shall be displayed until they are acknowledged, regardless of screen display. The operator will not have to wait for the sound to be completed before proceeding to other screen functions unless it is an emergency function.

1.5 ALARM PRIORITIES

A. As part of the VGUI, provide priority alarms and calls associated with different events and icons. Prioritization of alarms shall be limited to a total of seven levels. The Owner reserves the right to provide two additional priority levels or change the priority levels listed below during the Phase I software writing process.

1. Level #1: Duress Alarms
2. Level #2: Breech of interlocked Sally Port
3. Level #3: Door Alarms
4. Level #4: Intercom calls
5. Level #5: Inmate cell intercom calls

1.6 LOG IN

A. Each graphical user interface station has a log in screen when the station is enabled from Central Control. The user must input a valid username and password combination to gain access into the system. Each user will have a particular level of access – administrator, supervisor, user.

B. To change the door shunt feature, hold open alarm, intercom isolate feature, and the auto log off timer, the individual logged on must have supervisor level privileges.

C. Each operator station that is not located in a secure control room will have an auto-log off feature. If the operator has not performed a function in a configurable amount of time, the system logs off and rolls to Central Control.

1.7 DEVICE ICONS

A. The VGUI shall have Device Icons located in the Map Display including, but not limited to Door Icon, Intercom Icon, Camera Icon, Page Zone Icon, Duress Icon, Card Reader Icon and Group Control Icon. All maps shall be sized to allow for icons that measure 3/8" x 3/8" or larger when measured on actual monitor. Provide at least 1/8" separation between icons. The VGUI shall also have Function Icons located in the FCB including Unlock Icon, Stop Icon, Hold Open Icon, Door Isolate Icon, Intercom Isolate Icon, Interlock Override Icon, All Page Icon, Silence, and Reset Icon.

1.8 DOOR CONTROL

A. The steps required to open a swinging, sliding or overhead door are the same. The operator will first select the Unlock Icon in the FCB and then within three seconds, select the Door Icon in the Map Display. Other doors may be commanded to unlock by selecting other Door Icons within the three seconds of the first.

B. To stop motion of a sliding or overhead door the operator will select the Stop Icon in the FCB.

C. Door Status Alarm Indication:

1. Unauthorized Access / Breach:
   a. All controlled doors shall provide an unauthorized or breach alarm to the VGUI anytime a door opens by any means (such as forced or keys) that is not authorized by the security electronics control system (VGUI, PLC, card access).
   b. Monitored only doors do not provide unauthorized access or breach alarms unless otherwise noted in the drawings.
   c. Unauthorized access or breach alarm door breaches shall be programmed as a standard default feature and not provided as an option.
2. Door Held Open / Door Prop:
   a. All controlled and monitored doors shall provide an alarm to the VGUI anytime a door is held open beyond a configurable amount of time, unless otherwise noted in the drawings.
   b. The alarm can be silenced, reset and removed from the queue even if the door has not been re-secured. Every day that the hold open alarm is not resolved (a secure indication for that door has not been received into the system), a new hold open alarm for that door shall come into the VGUI.
   c. Door held or prop alarms shall be programmed as a standard default feature and not provided as an option.

D. The Door Icons in the Map Display shall have a graphical representation of the door. It shall provide a graphical difference between the LPS and DPS conditions. If either the LPS or DPS circuits open the VGUI shall report the door as being open/unsecure. If it is a swinging door it depicts the door swing and if it is a sliding or overhead door it shall depict the door as secure, in mid travel or fully open.

1. The Door Icon is gray and the door graphic is gray and is shown closed when the door is locked and secured.
2. The Door Icon is gray and the door graphic is red when the door is powered and opened.
3. The Door Icon is gray and the door graphic is fast flashing red when the door is breached or manually opened.
4. The Door Icon is gray and the door graphic is slow flashing red when the door alarm has been acknowledged by the operator.
5. The Door Icon is gray again and the door graphic is gray again when the door has been reset by the operator.
6. If there is a camera associated with door in alarm it shall be displayed on the call up monitor and the Camera Icon shall change to red.

E. Interlocked doors are bordered around their Icons in yellow when a door in a designated interlock group is unsecured. If two interlocked doors are attempted to be unlocked at

the same time, a pop up warning shall display on the screen along with a voice announcement.

1.9 DOOR SHUNT

A. Each controlled or monitored door will have the ability for the door breach alarm to be shunted. The door breach alarm does not alarm to the graphical user interface when the door has been shunted.

B. The door shunting feature shall be configurable by individual door by a supervisor level user.

C. Door icon shall display an "S", a change in color, or similar graphic change to signify when the alarms are shunted.

1.10 HOLD OPEN

A. Selecting the Hold Open Icon in the FCB will unlock the door and keep it electrically unlocked until the operator selects the Door Icon only. The Function Icon in the FCB shall stay illuminated during the three second selection process.

1.11 DOOR ISOLATE

A. Electrically controlled doors or doors that are controlled by card readers can be isolated so that they cannot be opened. To isolate a door the operator selects the Door Isolate Icon in the FCB and then selects the Door Icon. Other doors can be isolated within three seconds of the first. After three seconds the Door Isolate function cancels. Repeating the process on the same Door Icon will reverse the condition. When a door is isolated the Door Icon will have a black "X" over it indicating the door cannot be opened. If an operator attempts to unlock an isolated door, a pop up warning shall display on the screen along with a voice announcement.

1.12 EMERGENCY RELEASE

A. There shall be an "Emergency Evac" button located in the FCB. This button shall be placed on the screen in a location where the Operator is least likely to accidentally press it. When the operator selects this button a pop up screen shall ask the operator if they would like to continue. If the operator selects the "Yes" button (s)he will be able to emergency release doors by selecting the door icons on the display map. Opening the doors shall be a single step approach during an emergency release. The door icon shall flash red to acknowledge it has been opened. The doors shall remain unlocked until the operator cancels the emergency release function. Isolated doors shall become available to unlock in the emergency release. To relock the doors after an emergency release, the operator shall select "emergency evac" button again which will cycle the door locks to allow them to be closed/secured.

1.13 GROUP RELEASE

A. Each housing area shall have a group release button. This button shall be programed to work as a 2-step process (unlock + group release, or group release + confirmation pop up) that will open all cell doors in that housing area that are not isolated.

1.14 EXTERIOR DOOR

A. All doors to the exterior of the building and the exterior of the secure perimeter shall have an additional step to unlock the door. The normal sequence of pressing the unlock button on FCB and then the door icon shall activate a pop-up box confirming that this door is an exterior door.

1.15 INTERLOCK OVERRIDE

A. In the FCB, the unlock override button shall require confirmation ("yes" or "no") in addition to the two-step unlock process to open an interlocked door.

1.16 INTERCOM

A. Establishing audio communication at the VGUI with the remote intercom station shall be accomplished by either selecting the Intercom Icon on the Map Display or selecting the intercom call in the Pending Call List Display located below the site map.

1. When a station or speaker is off, the icon shall be gray.
2. When a station or speaker initiates a call to the VGUI control station, the icon shall flash green and be accompanied by a distinctive audible tone or voice announcement.
3. When the operator selects the Intercom call the station or speaker shall turn on. When a station or speaker is on, the icon shall turn solid green and the audible tone or voice announcement associated with the call shall be off.
4. A camera shall always be called up for view when a call is selected and the associated camera icon shall turn green to show its correlation to the intercom call. Intercom shall call up the nearest camera with the best view of who is standing at the intercom. Any locations without a camera with a direct view shall call up a camera that is closest to it to help show at least the general area.

1.17 ISOLATE INTERCOM

A. This feature shall allow the operator to turn off an intercom station. Incoming calls will still be received and the Intercom Icon on the Display map will still flash a green color, but no voice announcement will be given and the operator will not have to answer the call. The operator shall select the Icon Isolate Icon in the FCB and then the Intercom Icon in the Map Display and the Intercom Icon in the Map Display will have a black "X" over it indicating it has been isolated. Repeating the process will reverse the Intercom Isolate.

B. This feature shall only be available for supervisor level users.

1.18 PAGE

A. This function allows the operator to select one or more paging zones for a paging announcement. The operator will select the Page Icon in the Map Display. The Page Icon will change to a green color during the paging operation and back to gray when the paging operation is completed.

1.19 ALL PAGE

A. The FCB shall allow the operator to perform a paging operation in the entire facility. This function shall also include all intercom stations.

1.20 VIDEO

A. Establish video communications at the VGUI with a VMS camera. Operator shall accomplish by selecting a Camera Icon in the Map Display.
   1. Upon selection of a Camera Icon the Camera Icon will turn blue and the VMS image will be displayed on the video monitor at the operator station. Camera call up shall take less than 2 seconds and shall be live video without any time delay.
   2. Selecting the Camera Icon again shall cancel the video and return the Camera Icon to its gray color. The video monitor shall be black.

1.21 DURESS ALARM

A. When a duress alarm is activated the duress alarm icon on the screen shall flash red and there shall be a voice announcement alerting the operator that there is a duress alarm. If there is a camera associated with the duress alarm the camera shall be automatically displayed on the spot monitor at the operator station.

1.22 ELEVATOR CONTROL

A. The elevator manufacturer/installer shall coordinate all indications and control with the SCSC. Coordinate all wiring requirements for elevator status, intercoms, card readers and cameras in the cab of the elevator.

B. An Elevator Control tab on the side of the interface screen shall provide for a PLC dry-contact interface between the Security Control System and the elevator control system for elevators in detention areas. The functions AUTOMATIC MODE, SECURE MODE, SEMI-SECURE MODE, CALL TO FLOOR, OPEN DOOR, and CLOSE DOOR shall be provided. The indications CAB AT FLOOR, DOOR OPEN, DOOR CLOSE, AUTOMATIC OPERATION and MANUAL OPERATION shall be provided.
   1. AUTOMATIC MODE – When the elevator is operating in automatic mode, the VGUI shall provide indication only of the operation of the elevator. The elevator shall operate in its normal programmed mode via card readers and/or push buttons.
   2. SECURE MODE – When the elevator is operating in SECURE MODE, all floor call buttons and card readers inside and outside the elevator cab shall be disabled. The VGUI shall control the destination floor of the elevator. When the elevator arrives at the designated floor, the elevator doors shall remain closed until the OPEN DOOR function is activated by the VGUI. The elevator doors shall remain open until the CLOSE DOOR function is activated by the VGUI.
   3. SEMI-SECURE MODE - When the elevator is operating in SEMI-SECURE MODE, all floor call buttons and card readers inside and outside the elevator cab shall be disabled. The VGUI shall control the destination floor of the elevator. When the elevator arrives at the designated floor, the elevator doors shall automatically open and remain open until the CLOSE DOOR function is activated by the VGUI.

1.23 UPS ALARMS

A. Each UPS shall provide dry contact outputs to the security system for monitoring at the VGUI station. The VGUI station shall indicate when the UPS has low battery and trouble.

1.24 EMERGENCY GENERATOR

A. The emergency generator shall provide three dry contact outputs to the security control system for monitoring at the VGUI station. Coordinate division of responsibility of all conduit, wiring and terminations with generator provider.

1.25 PLC FAULT, LOW BATTERY

A. Each PLC within the system shall provide dry contact outputs to the security system for monitory at the VGUI station. The VGUI station shall indicate when the PLC has low battery and fault conditions.

1.26 ALARM OCCURRENCE LOG: Each time an alarm comes into the system, the Occurrence Log shall provide a text-based entry system required for operators to log events or notes related to the alarm before the alarm can be reset. Provide a "screen" for the Owner to customize by alarm type which alarms require a mandatory response before being reset. This list shall only be edited by admin level users in a check yes or no format.

A. Entry of new occurrence logs

1. The operator shall enter text via the attached keyboard or option of using the software keyboard. The software keyboard shall include all standard keys including, shift, caps lock, backspace, enter, and arrow keys. As characters are selected on the keyboard they should be displayed in the appropriate field. The software keyboard shall have a CLOSE button.
2. The operator shall select the SUBMIT button to save the entered text to the SMS. After submitted, status should indicate that the text has been sent and saved successfully, and the title and log fields should be cleared. If the text is not sent and saved successfully, the status should indicate "Log Entry Failed," and the title and log fields should not be cleared. The operator shall select the CLEAR button to clear the title and log fields.
3. The operator shall select the VIEW LOG BOOK button to view previous entries of that specific VGUI station within the last 24 hours.
4. The Occurrence Log entry shall be capable of 3800 characters.

B. Viewing previous entries

1. The operator shall be capable of displaying up to 100 logged entries at the VGUI.
2. The operator shall select the NEW LOG ENTRY button to return to the new occurrence log entry screen.

C. All data shall be logged to SMS.

1.27 CARD READER ISOLATE

A. Each card reader throughout the facility shall be able to be isolated from the VGUI station. To isolate the card reader, the operator selects the "card reader isolate" icon and within three seconds the card reader button the operator would like to isolate.

B. The card reader icon will have a black "X" over the reader indicating that the reader is isolated. Isolated readers cannot be used for movement through a door while the reader is isolated."

1.28 SECURITY MANAGEMENT SYSTEM

A. The system shall record all of the previously mentioned operations activity to allow for automated sorting and report generation. Refer to Section 285900.

PART 2 - PRODUCTS

2.1 COMPUTERS:

A. Video Graphical User Interface (VGUI) shall consist of PC-based workstations providing the minimum distributed processing capability as per the following.

1. Intel Core i5-4570 quad core, 3.2GHz turbo processor or better, 512K cache, 8GB 1600MHz DD3 Memory, 250GB SSD hard drive, 2 USB ports, network card for Ethernet operation, CD-ROM drive, sound card, video accelerator, running Windows 10 pro. Provide UPS power for all workstations.
2. Size CPU housing in Small Form Factor or as required to fit the console/casework in which it will be located.
3. This spec shall be exceeded as necessary when multiple systems are combined onto one station.
4. Approved Manufacturers:
   a. HP
   b. Dell
   c. IBM

2.2 MONITORS

A. Provide for each Central Control VGUI operator station a 24" LCD flat panel touch screen with 1920 X 1080 pixel resolution as indicated on the Drawings.

B. Approved Manufacturers – Dell, Samsung, NEC, HP

2.3 MONITOR ARMS

A. Provide monitor arms for all monitors placed on casework. Arms shall be able to tilt, swivel, pan and rotate.

B. Desktop monitor arms shall have enough range to allow the top of the monitor to be angled back greater than 45° while the bottom of the monitor is flush or within half an inch to the desktop surface. Provide all required hardware/mounting kits to permanently mount the arms to the desktop surface. Coordinate placement prior to installation.

C. Approved Manufacturers – Egrotron, approved equal.

2.4 CONTROL STATION AUDIO COMPONENTS

A. Provide the following audio components for each VGUI station indicated on the drawings.

1. Desktop Microphone unit with PTT (push to talk) button to allow the user to communicate on the audio system. Microphone levels shall be adjustable from the VGUI station.
   a. Condenser Microphone:
      1) Sensitivity: 1.3 mV/Pa
      2) Impedance: 1000Ω
      3) Frequency: 50-16,000 Hz
      4) Operation voltage: 5V via USB
      5) S/N ratio: More than 60dB
   b. Provide push-to-talk push button with 6' cord, flange base with mounting holes and an audible click feedback.
   c. Provide impedance adapter for proper audio level interface between sound card on VGUI control station PC and remote intercom amplifier.
   d. Desktop microphone shall be Audix USB12 or approved equal.
2. Desktop speakers to allow the user to hear communications from the audio system. Volume level shall be adjustable from both the speakers and VGUI station. Desktop speakers shall be Dell AX210 or approved equal.
3. At SCSC's option, a desktop intercom station may be substituted for the desktop microphone and speakers at each VGUI station. Desktop intercom station shall be a vandal-resistant loudspeaker/ microphone assembly with push-to-talk (PTT) button switch and gooseneck microphone. Approved models:
   a. Available Products: Subject to compliance with requirements , provide one of the following products:
      1) Harding TMM-440
      2) Jeron 4349
      3) Quam DTS1
4. Provide a single gang wall-plate for mounting to a 3-1/2" deep back box. Wall-plate shall include stereo-type jacks for microphone, speaker and push-to-talk button. Wall-plate shall include RJ-45 jack for Ethernet communications between VGUI control station PC and PLC System Ethernet network.
5. Source Limitations: Obtain each type of desktop audio component from single manufacturer and provide same components for all VGUI stations.

2.5 TOUCHSCREEN OVERLAYS:

A. Touchscreen overlays shall be of the analog capacitive technology with 1024 touch points resolution. Linearity shall be less than +/- 1% error with a drift offset of no worse than +/- .5% anywhere on the screen. Mean Time Between Failures (MTBF per MIL-HANDBOOK-217D) for the controller shall be greater than 176,000 hours and a touch life in any one location of 20 million touches. Connection from the Touchscreen to the computer shall be bi-directional asynchronous RS-232C or Universal Serial Bus (USB). The Touchscreen driver shall allow the touch area to activate upon release from the Touchscreen only. Commonly called liftoff mode.

1. 3M Touch Systems (Microtouch)

2. ELO

2.6 VIDEO GRAPHIC USER INTERFACE

A. VGUI Configuration Software: The configuration software must be compatible with the PLC programming software. The VGUI stations are primarily for operator interface only. Critical control functions, such as door control, duress, and utility control are to be executed by the PLC CPU program(s).

B. Acceptable manufacturers:

1. Wonderware InTouch
2. Indusoft
3. ProVision

C. All software shall be licensed (registered) to the Owner. Each operator station regardless of size shall be provided with an unlimited tag software package.

D. The SCSC shall turn over to the Owner all programming passwords, source codes, backup copy on CD or USB drive of all software programs, runtime and programming licenses and programming schedules at the end of the project.

PART 3 - EXECUTION

3.1 SOFTWARE REVIEW:

A. Refer to Section 285000 for Software Meeting Requirements.

END OF SECTION 285020

SECTION 285030 – CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 DESCRIPTION OF WORK

A. Provide all material and labor for all cabinets and enclosures required by the security control system for this project.

B. Provide all connection accessories to make this a full working system. All fittings, extenders, and supplementary items shall be provided for a complete and security installation.

1.3 SUMMARY

A. Provide cabinets and enclosures for the protection and security of the equipment contained within the cabinet or enclosure.

B. All cabinets and enclosures shall be rated for the space within which they are installed unless noted otherwise.

1. Type 1: Indoor use - protect against contact with equipment located inside and protect against dirt and dust.
2. Type 3: Outdoor use – protect against windblown dust and rain, and protect against formation of ice on the enclosure
3. Type 3R: Outdoor use - protect against windblown dust and rain, and protect against formation of ice on the enclosure
4. Type 4: Indoor or Outdoor use – protect against falling rain, splashing water and protect against the formation of ice on the enclosure.
5. Type 4X: Indoor or Outdoor use - protect against falling rain, splashing water and protect against the formation of ice on the enclosure; resists corrosion
6. Type 12: Indoor use: provide protection against dust, dirt, fiber, dripping water, and condensation of non-corrosive liquids.

C. Refer to other Div 28 sections for cabling, installation, identification and termination requirements.

1.4 SUBMITTALS

A. Provide all product data for the cabinets and enclosures provided on this project.

B. Provide cabinet and enclosure layouts of all security control system rooms. Provide all elevations and floor plans with dimensions indicating size of enclosures and clearances required.

C. Provide cabinet and enclosure temperature testing results.

1.5 GUARANTEE

A. The SCSC shall guarantee all equipment for a period of two (2) years commencing with Substantial Completion. The guarantee shall cover all costs for Warranty Services, including parts,

labor, prompt field service, pick-up and transportation. All manufacturers' warranties shall be passed onto the Owner beyond the warranty period.

PART 2 - PRODUCTS

2.1 GENERAL

A. Cabinet & Enclosures for Security Equipment
   1. Acceptable Manufacturers
      a. Atlas Soundolier
      b. Eldon
      c. Hoffman
      d. Middle Atlantic Products, Inc.
      e. Winsted

B. Cabinet & Enclosures for Server Equipment
   1. Acceptable Manufacturers
      a. HP (10642G2)
      b. APC (AR3100)
      c. Belkin (RK1000)
      d. Dell (Startech RK4242BK0)
      e. Chatsworth (GF-1A320)

2.2 MATERIALS

A. Cabinets
   1. Cold Rolled steel units, 12 Ga angles, 14 Ga posts, 16 Ga molding and braces.
   2. 16 Ga flush mount doors; flush or louvered with flush pulls
   3. 16 Ga flush mount; flush or louvered, easy removal.
   4. Provide door with key lock on all cabinets.
   5. Provide louvers as required for cooling equipment.
   6. Provide ventilation fans to maintain manufacturer recommended temperatures for equipment.
   7. Provide electrical outlet and power strip for power supplies. Install wire ties around plugs to prevent the plug from being removed accidently.
   8. Floor Mounted Units
      a. Door Control & Video Equipment Cabinets: Nominal 30" deep x 30" wide; 72-90" high; 24" EIA rack mounting frames
      b. Intercom & Paging Equipment Cabinets: Nominal 30" deep x 24" wide' 72-90" high; 19" EIA rack mounting frames
      c. Provide blank plates on all unused areas of the cabinet.
   9. Wall Mounted Units
      a. Provide only in room locations with size restrictions that would prevent the use of floor mounted units with proper NEC clearance from front and rear.

B. Enclosures
   1. Provide wall mounted equipment as need in security control system rooms.
   2. Provide hinged door with keyed lock.

3. Provide ventilation fans to maintain manufacturer recommended temperatures for equipment.

2.3 FABRICATION

A. Install enclosures to easily accommodate interconnecting cables from above or below through the use of cable trays or conduits.

B. Combine wires/cables by types and boards. Provide installation meeting National Electrical Code clearances, cabling installation and circuit separation requirements.

C. Organize all wiring and cable routing by device types. Provide cabling support and tie up throughout the cabinet to provide a clean installation.

D. No splices permitted from field device to head end connection.

E. Provide grounding of all equipment as required by NEC.

F. Provide protection from contact of terminals and exposed conductors.

G. Provide din rail and mounting equipment for all applications. All equipment shall be accessible from each side of the cabinet as needed. Do not block access to required equipment to be maintained.

PART 3 - EXECUTION

3.1 INSPECTION

A. Check location, "roughing in", and field dimensions prior to beginning work.

B. Do not begin installation until all unsatisfactory conditions have been corrected.

C. Verify field measurements are as shown on Drawings and as instructed by manufacturer.

D. Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION/APPLICATION OF ALL SECURITY PRODUCTS

A. Provide wire management throughout cabinets and enclosures.

B. Replace equipment, components, & wiring as required to achieve a fully functional system.

END OF SECTION 285030

SECTION 285100 – AUDIO COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 SUMMARY

A. This section includes the requirements and operational characteristics for an Audio Communication System, which is an integral part of the Security Control System. Audio Communication systems included are:

1. Remote intercom stations, ceiling-mounted speaker assemblies and speaker horns.
2. Audio system head-end and control components utilizing Harding Instruments, MTI, or approved equal.
3. General and Emergency Paging components.
4. VGUI control station audio components.

B. All components used in creating the communication system shall be of the same manufacturer and/or approved by the manufacturer for system compatibility. Equipment and specified herein is for the purpose of establishing the types of equipment and the minimum quality of equipment required. It shall be the Security Control System Contractors responsibility to assure the compatibility of all access control equipment, software, programming, cable, mounting methods, etc. that are used in providing a complete system.

C. Provide a PLC-controlled, facility-wide, digital audio communication system, which is fully integrated with the Security Control System. This system shall provide two-way, remote reply intercommunication between VGUI control station(s) and users and remote intercom stations, speakers, and horns. This system shall allow any remote intercom station or ceiling monitoring speaker to be answered by the VGUI control station in primary control of that particular area, or by the VGUI control station(s) in Central Control.

D. The audio system will be free from any 'popping', 'cracking' or 'humming' at all times. Audio annunciated at the control station shall be of sufficient quality that voice or other common sounds can be correctly interpreted at a distance of 2-4' directly in front of the VGUI system.

E. Each VGUI control station shall have its own dedicated talk path to all devices under its control. Sharing of talk paths between VGUI control stations will not be accepted. System shall provide for call forwarding/takeover from one VGUI control station to another after an owner specified time.

F. The audio communication system shall interface with the VMS system via the PLC System.

G. Each remote intercom station or ceiling monitoring speaker shall be annunciated on any VGUI control station in primary control of that intercom station or speaker's area.

H. Provide an audible feedback tone at each intercom station to indicate to the user that the push button has activated a call in function.

I. The remote intercom station or ceiling monitoring speaker's audio shall be driven through the VGUI control station computer speakers or a stand-alone intercom master station Use a desktop intercom master station at locations without VGUI control. Audio from the VGUI control

station microphone to the remote intercom station or ceiling speaker shall only be active while the VGUI control station push-to-talk push button is depressed.

J. Each station's volume level shall be independently software controlled. Level settings shall remain in effect until modified by a future adjustment.

K. The paging system shall have the capability of reaching individual areas of the facility, or the entire facility.

L. Paging zones shall be grouped logically, and final zone configuration shall be coordinated with the architect and owner during the submittal phase.

M. Intercoms shall be able to be included in paging zones.

N. Remote intercom stations and ceiling monitoring speakers shall be programmed to call the intercom master station that is in control of that local area. If local control is transferred or the call is not answered within a preselected number of rings or predefined length of time, the call shall be automatically forwarded to the Central VGUI control station. Calls assigned to the local intercom master stations will not show up on the Central VGUI control station until such calls are forwarded to the VGUI control station.

O. Acceptable Manufacturer:

1. Harding Instruments – DXL Series
2. MTI – digiCom Series

P. Provide a talk-thru communication system, which shall provide a two-way, hands-free duplex audio communications link between a partition.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Remote Intercom Station

1. Intercom stations shall be designed for mounting on standard 2-gang outlet boxes. Faceplates to be constructed of 11 gauge brushed stainless. Internal steel offset grille to restrict inserting objects through speaker grille. Stations shall be ruggedly constructed and resistant to damage from soil and sprays.
2. Each intercom station shall incorporate an internal loudspeaker, microphone preamplifier and multiplexing circuitry. One pushbutton shall be provided on each station.
3. Pushbuttons shall be single piece stainless steel construction and shall be backstopped to prevent excessive travel. Switch shall have positive tactile action with 1 million-operation lifetime.
4. Loudspeakers shall be waterproof mylar cone type.
5. Provide weatherproof remote intercom station when the station is located outside. Outdoor intercom stations are to be identical in all respects to standard intercom stations except that all metal plates and hardware to be stainless steel, and internal circuitry and components to be conformal coated.
6. The remote intercom station shall be a Quam model CIS4 series or approved equal.

B. Inmate Emergency Call-In Station (Located inside Sleeping and Holding rooms)

1. Shall be flush mounted in the wall or hollow metal frame jamb of the cell, 18" AFF as shown on drawings.

2. Shall utilize push button call activation to the appropriate intercom master station.
3. Inmate Emergency Call-in Station shall comply with the specifications for Remote Intercom Stations.

C. Call Switch

1. As indicated on contract documents, provide Call Switches made of 11ga stainless steel, with vandal resistant switch that is made to mount to single gang electrical box.
2. Call Switch shall call into the intercom call list like an intercom.
3. The Call Switch shall be Quam CIB2 or approved equal.

D. Drive-up Intercom/camera Pedestal

1. Provide and install intercom/camera pedestal. SCSC is responsible for coordinating all conduit, wiring, terminations, and surge protection with Division 26 to make this a working system.
2. Unit shall be constructed per detail on Drawing SE3.1.
3. Material shall be 12 gauge cold rolled steel, powder coated. Coordinate color during submittal phase.
4. Unit shall be mounted per the detail on Drawing SE3.1.

E. Paging Speaker Assembly

1. Ceiling and Wall mounted speaker assemblies shall consist of a Lowell 8C10W-25 speaker, a Lowell SQLK-8 baffle and a Lowell P875X back box for recessed-mount applications and Lowell CB84 back box for surface-mount applications. Exterior applications shall use assemblies rated for exterior use such as the Quam System 6VPS. Approved manufacturer; Quam, Lowell, or approved equal.

F. Relay Selection Panel

1. The relay selection panel shall provide individual relay control of speaker lines for paging. Provide all required PLC outputs for interface to relay selection panel(s) for a fully-functional audio communications system.
2. The panel shall contain one control circuit per speaker line that shall provide for the selection of any line. The panel shall provide a common audio input for all speaker lines. The panel shall contain relays that operate to connect the common audio input with the appropriate speaker lines as controlled by the intercom control circuits. The panel shall contain a program bus that shall provide for program distribution to all speaker lines.
3. The relays shall be of sealed type construction with a life expectancy of 10,000,000 operations. Relay contacts shall be rated at 2A. Less than 0.75A at 24Vdc shall be required to operate up to 25 relays simultaneously.
4. All wire connectors to the panel shall be to insulation displacement connectors. The connectors shall accommodate 22 AWG for speaker line connections and 18 AWG for audio input connections.

G. Paging Amplifier

1. Provide quantity required to support the number of field devices to be supported.
2. The paging amplifier shall be mounted in a standard 19-inch rack.
3. The paging amplifier shall be a TOA model P-906MK2 or P-912MK2 or approved equal, depending on power requirements of installed equipment.

H. VGUI Control Station Audio Components

1. Refer to Section 285020 for Control Station Audio Components.

I. Desktop Intercom Master Station
1. Desktop intercom master stations shall be used in locations that do not have VGUI control systems.
2. Desktop intercom master stations to consist of display, keypads, internal speaker/microphone, telephone handset with hook switch, headset jack, and external buzzer contacts.
3. The display module to consist of 4 line by 20-character alphanumeric LCD display mounted behind a brushed stainless steel faceplate. Display is to include a scratch and impact resistant window, adjustable viewing angle, and adjustable back lighting. Character size 0.19" H x 0.12" W.
4. Five function keys to be provided below the display to enter menu selections. Function key action to be labeled on display and vary according to location in the menu structure and current options available.
5. Separate 19 button keypad to include standard 12 numeric keypad keys, two scroll keys, enter key, clear key, headset key, mute key, and press-to-talk key.
6. Key switch lifetime for all keys, 10 million operations.
7. Telephone handset with coiled cord, press-to-talk bar, and hook switch cradle to be mounted on side of master station. Lifting handset from hook switch automatically disconnect loudspeaker/microphone communications.
8. Desktop mounted intercom master station top housing assembly to be fabricated with single piece, brushed stainless steel, slope-faced faceplate. Rear, bottom, and side panels to be single piece formed steel with welded joints and matte black finish. Overall housing dimensions, excluding rubber feet, 9.5" W x 10.25" D x 4.5" H.
9. Provide quantity of intercom master stations as indicated on the Drawings.
10. Provide adequate number of intercom master ports on the master control card located in the DCC.
11. The intercom master station shall be a Harding Instruments model IMS-440-212.

J. Talk-thru Communicator
1. The talk-thru communicator shall provide a two-way, hands-free duplex audio communications between a partition.
2. The talk-thru communicator shall contain two voice channels, each incorporating a microphone amplifier, VOX switch, compressor, background noise monitor, attenuator controls, level detectors, and a bridge amplifier.
3. The sound amplifier shall not exceed 0.2% THD.
4. The talk-thru communicator shall include an operator-side gooseneck microphone, power on/off switch, power-on green LED, "talk" volume control and "listen" volume control. The exterior shall be equipped with a 2 ¼" ferrite, magnetic speaker and electret microphone. An AC adapter, which steps down 120VAC to 18VDC shall be provided.
5. The Type 1 talk-thru communicator (TTC-1) shall incorporate a Class II bullet-resistive insert, being able to withstand a standard bullet from a .357 Magnum firearm.
6. The SCSC shall coordinate with the partition or glass provider for the appropriate cutout size for the Type 1 unit. The Division 26 contractor shall provide local 120VAC power for each unit.
7. Type 1 Talk-thru communicators (TTC-1) shall be equivalent to Haven Technology model #SC-100, or approved equal.

8. Type 2 Talk-thru communicators (TTC-2) shall be equivalent to Haven Technology model #SC-300, or approved equal.
9. Installation: Coordinate with hollow metal manufacturer, and construction document details to provide installation into the hollow metal frame section with concealed conduit for the supply of its operating power. Provide low-voltage power to the TTC from the Security Electronics equipment room.

K. Talk-Through Intercom Unit (TTU): (Located at Visitation rooms; refer to Drawings for locations and quantities.)
1. Series/Manufacturer
   b. TTU-5/Norcon Comm. Inc,; Inwood L.I., New York
   c. SC-600/HAVEN Technology Corp.; Corona, CA
2. Function
   a. Hands–free two–way conversations.
   b. Unit shall be bullet resistant with stainless steel faces.
3. Components
   a. Outside faceplate shall be approximately 13" H x 4 ½" W stainless steel with Torx-head security fasteners with center reject pin.
   b. Back-boxes shall be 11 ½" H x 3 ½" W x 2" D.
   c. Electronic assembly shall have as a minimum the following:
      1. Audio power: 2 watts
      2. Distortion: Less than 2%
      3. Listen Mode: 20 dB compression
      4. Talk Mode: Automatic call voice controlled (VOX)
      5. Microphones: "Electret"
      6. Power source: Line voltage in concealed wall conduit
      7. Power Supply: Input: 120 VAC, 60 Hz, Output: 15 VDC, 175 mA
4. Installation: Coordinate with hollow metal manufacturer, and construction document details to provide installation into the hollow metal frame section with concealed conduit for the supply of its operating power. Provide low-voltage power to the TTU from the Security Electronics equipment room.

L. Video Intercom System
1. Manufacturer
   a. Aiphone JP Series
   b. Approved equal.
2. Master Station – Aiphone JP-4MED or approved equal.
3. Door Station – Aiphone JP-DV, or approved equal.

M. Spares:
1. Refer to Section 285000.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and areas are ready to receive work.

B. Verify field measurements are as shown on Drawings and as instructed by manufacturer.

C. Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION

A. All system equipment to be contained within equipment racks, cabinets, or closets. If more or larger equipment racks or cabinets are required than exist or are indicated on the drawings, allow for such additional equipment racks and cabinets in contract price.

B. All system equipment equipped with plug in power connectors to be connected to a dedicated receptacle. Do not use tap connectors for plugging in multiple plugs into a single receptacle.

C. All cable within equipment racks, cupboards, and cabinets, or on backboards, to be neatly bundled and secured. Wires shall not be nicked, have strands removed, or have frayed strands when removing insulation or terminating.

D. Factory manufactured interface cables to be provided for each field interface board. Terminal blocks to be provided in cabinet or on backboard for factory cable interface to field wiring.

E. Wiring shall be executed in strict adherence to standard broadcast practices.

F. Identify wiring by continuous insulation color. Where multi-conductor cables are used, use the same color-coding system for identification of wiring throughout.

G. Maintain uniform phasing and color-coding throughout system.

H. Name identification of wiring:
   1. Identify wiring at all equipment locations, pull boxes, junction boxes and outlet boxes.
   2. Develop a uniform identification scheme for use throughout the system.
   3. Record wire name identification on all applicable drawings and provide wiring tables within the operating and installation manuals.

I. Use one of the following marking materials:
   1. Heat shrink sleeves.
   2. Clear plastic tape wrap-on strips with designated labeling section.
   3. Slip-on identification bead markers or sleeves.

J. Replace equipment, components, and wiring as required to achieve a fully functional system.

END OF SECTION 285100

SECTION 285200 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 WORK IN THIS SECTION:

A. The system shall consist of IP cameras, lenses, and monitors, mounting hardware, housings, network video servers, Video Data Storage Equipment, and Client workstations with software for live and recorded image viewing.

B. The system shall permit visual monitoring and surveillance of selected areas automatically based on events via the PLC for intercom and duress stations.

C. Provide video integration at all VGUI locations as per spec section 285020.

D. Exterior cameras in areas of low light shall be inclusive of IR or low light capabilities to produce a clearly identifiable image when viewed.

1.3 QUALITY ASSURANCE

A. NEC Compliance. Comply with applicable requirements pertaining to TV equipment and signal distribution systems

B. UL Compliance. Comply with applicable requirements of UL safety standards pertaining to television equipment and accessories. Provide TV equipment and accessories, which are UL-listed and labeled.

C. EIA Compliance. Comply with applicable requirements of Electronic Industries Associations standards pertaining to television cameras and monitors.

1.4 SYSTEM DESCRIPTION

A. The system shall provide for the visual surveillance of all camera locations from the VGUI operator station.

B. The system shall be integrated with the VGUI to allow events to affect the camera callup.

C. Selected monitors shall have multiple screen display mode with selectable outputs.

D. Controls shall allow manual selection of any camera display option.

E. The system shall allow full frame rate (30fps) and full resolution (1080p HD) live viewing on all camera inputs and simultaneous recording at a lower frame rate and/or resolution to manage the use of storage space.

F. Provide Power over Ethernet (PoE) for all cameras within the system.

G. The system shall support JPEG, H.264, MJPEG, MPEG-2, MPEG-4, and be configurable on a per camera basis.

H. Proprietary hardware or installation of video capture cards shall not be allowed.

I. The system shall utilize TCP/IP communication protocols and reside on an Ethernet LAN physical layer.

J. Client workstations shall be configured with dual monitor outputs to support multiple live and recorded views. Each monitor shall be capable of 16 images simultaneously.

K. All cameras shall have vandal resistant grade housings.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION:

A. Subject to compliance with the requirements to provide equipment from the manufacturer listed herein or an approved equivalent.

2.2 MONITORS

A. Provide 24" HD LED Monitors that meet the following requirements:
1. Digital resolution of up to 1920 x 1080 pixels.
2. HDMI, DVI, and VGA inputs.
3. Built-in speaker.
4. Connections for video and audio input/outputs.
5. On-screen display for setup and adjustment of the monitor viewing parameters.
6. NTSC/PAL standards compliant.
7. Equipped with base for placing the unit on a flat surface.
8. Tint, color, brightness, contrast, volume, and power on/off controls.
9. Black plastic cabinet with a black matte finish.

B. Manufacturer:
1. Bosch
2. Hanwha
3. Pelco
4. Sony
5. Vicon
6. Approved Equal

2.3 MONITOR ARMS

A. Provide monitor arms for all monitors being mounted on casework. Arms shall be able to tilt, swivel, pan and rotate.

B. Desktop monitor arms shall have enough range to allow the top of the monitor to be angled back greater than 45° while the bottom of the monitor is flush or within half an inch to the desktop surface. Provide all required hardware/mounting kits to permanently mount the arms to the desktop surface. Coordinate placement prior to installation.

C. Approved Manufacturers – Egrotron, approved equal.

2.4 INTERIOR / EXTERIOR FIXED DOME IP CAMERAS

A. The indoor fixed camera dome shall incorporate a fixed camera/lens combination. The camera dome shall be available for indoor surface mounting. The high-resolution day/night camera shall be available with an integral 3.3-12 mm or 9-22 mm varifocal autoiris lens. The lenses shall be available motorized to allow for remote configuration of zoom and focus (motorized focus and zoom - MFZ); it shall be zoom scalable so the iris shall automatically adjust to zoom condition. Day/night operation shall be achieved using a built-in IR-cut filter. A smoke polycarbonate lower dome that is secured by tamperproof screws shall be included. Exterior cameras shall have black housings. Interior camera housings shall be lighter in color to be coordinated during the submittal phase.

B. The latest model available from the camera manufacturer shall be utilized.

C. The camera position shall have a three-direction adjustment, allowing for adjustment of pan, tilt and lens rotation (roll), for any angle of view required.

D. The camera dome shall be powered by PoE, 24 VAC or 12 VDC.

E. The camera dome shall have dual streaming video and support H.264 and M-JPEG (2nd stream only) compression.

F. Camera features shall include electronic iris, WDR, AGC, BLC, white balance, flip, mirror and motion detection.

G. The camera dome shall meet the FCC requirements for a Class A device. It shall include support for the industry-standard ONVIF interface.

H. The camera dome shall provide a slot for an SD card for local storage.

I. Cameras shall be Color with a UL listing.
   1. Imaging sensor: 1/2.5" CMOS Sensor
   2. Lens: Varifocal 3.3 -12mm or 9 – 22mm
   3. For cameras indicated as wide-angle lens cameras, provide wide-angle lens ranging between 1.8 to 3 mm.
   4. Electronic Zoom: 2-10x (based on client software)
   5. Minimum illumination: Color 0.07fc, B&W 0.007fc
   6. Video compression: H.264 with MPEG-4 available on 2nd stream
   7. Casing: impact-resistant casing and polycarbonate smoked dome
   8. Resolution: 1080P
   9. Frame Rate: 2.5 – 30fps
   10. Power: camera: PoE (IEEE 802.3af) class 2
   11. Operating Temperature: with heater: (-20 – 122deg F)
   12. Supported protocols: HTTP, HTTPS, TCP, RTSP/RTP/RTCP, IGMP, SMTP, IPv4, IPv6, DHCP, NTP, ARP, DNS

J. Acceptable Manufacturers
   1. Axis
   2. Avigilon
   3. Bosch
   4. Flir
   5. Hanwha

6. Pelco
7. Vicon
8. Or Approved Equal

2.5 EXTERIOR/INTERIOR 180°, 270°, 360^{O} MULTI-LENS IP CAMERAS

A. Megapixel camera with true Day/Night functionality (mechanical IR cut filter), POE and Auxiliary powered, with adjustable 2 axis camera gimbals for 360^{o} pan and 90^{o} tilt, privacy mask, motion detection, bit rate control and multi-streaming.

B. The latest model available from the camera manufacturer shall be utilized. Provide mounting equipment as needed.

C. Cameras shall be Color with a UL listing.
   1. Image Sensor: 12MP = 3MPx4
   2. Optical Format: 1/3.2"
   3. Lens: (4) F1.6, 8.0 mm, IRH-FOV: 88^{o}
   4. Electronic Zoom
   5. Minimum illumination: Color: 0.25 lux
   6. Video compression: H.264 with MPEG-4 available on 2nd stream
   7. Outdoor rated IP66 and IK-10 impact-resistant housing and polycarbonate dome.
   8. Frame Rates: Full resolution: 5.2fps (8192 x1536), 1/4 resolution: 17fps (2048x1536)
   9. Power: camera: PoE class 3
   10. Operating Temperature: with heater: -40^{o} F to 122^{o} F
   11. Supported protocols: RTSP, RTP/TCP, RTP/UDP, HTTP, DHCP, TFTP.

D. Acceptable Manufacturers:
   1. Arecont Vision AV12176DN (basis-of-design)
   2. Axis
   3. Avigilon
   4. Flir
   5. Hanwha
   6. Pelco

2.6 CEILING CORNER MOUNT IP CAMERA

A. The latest model available from the camera manufacturer shall be utilized.

B. The indoor high-security camera shall incorporate a housing, camera, and lens. Its design shall be specifically for use in custodial suites and prison cells. The high-resolution day/night camera shall be available with an integral 2.0 mm wide angle lens.

C. The camera shall be waterproof and shall fit into a 90° corner. It shall consist of a two part steel assembly, a fixed mounting frame and a removable front plate. The front plate shall be recessed and secured to the fixed frame with security screws. The front plate shall have a window to protect the camera. Once installed, it shall be able to be permanently sealed to the wall to make the housing ligature proof.

D. The camera shall support proprietary H.264MP and M-JPEG compression.

E. The camera shall have an adjustable mount that shall allow it to be tilted up or down for an exact view.

F. The camera shall be powered by either PoE or 24 VAC.

1. Imaging sensor: 1/2.7" CMOS
2. Lens: 2.0mm
3. IR Coverage: 30'; 3 LED, 940nm
4. Video compression: H.264, MPEG-4,
5. Casing: Vandal-resistant and anti-ligature
6. Resolution: 1440 x 1080
7. Power: PoE or 24VAC
8. Operating Temperature: 14-122 deg F

G. Acceptable Manufacturers

1. Axis
2. Bosch
3. Flir
4. Hanwha
5. Pelco
6. Vicon

2.7 VMS NETWORK SWITCHES:

A. Specifications:

1. 24 or 48 Ethernet 10/100/1000 PoE+ ports with minimum of 1 Gigabit uplink
2. 370-740 W of available PoE power.
3. 4 - Gigabit Ethernet SFP ports for stacking or uplinks
4. Ability to stack units or implemented as a distributed stack at multiple locations and managed as a single-IP entity
5. Multicast routing, IEEE 802.3af Power over Ethernet
6. High resiliency and continuous availability with active load sharing and support for ultra-fast failover recovery
7. Layer 2 security with ACL ports, IEEE 802.1X operation with multiple authentication mechanisms.
8. Have the ability to prioritize converged network traffic to ensure high levels of service for latency-sensitive applications

B. Acceptable Manufacturer

1. Cisco
2. HP
3. Approved equal

2.8 LENSES

A. This contractor shall include in their estimate lenses adequate for the functional criteria described and shall change lenses without additional cost to the Owner such that all areas are

appropriately covered under actual test conditions. Cameras monitoring specific doors shall have lenses adequate to identify the individual.

B. Cameras monitoring outdoor activity, long corridors, and large indoor areas shall have lenses adequate to identify the nature of the activity in the area.

C. During the final testing of the system, the Owner shall sign off on each camera view for proper angling and coverage. This signed list shall be submitted before substantial completion.

2.9 CAMERA HOUSINGS AND SUPPORTS

A. Recessed ceiling or wall mounted housing shall be a high security camera enclosure rated for interior or exterior use with a built in heater. For exterior wall mounted applications provide appropriate mounting arms and brackets.

B. Provide all accessories to accomplish the specified mount according to the camera schedule. The mounts shall all have internal protective passage for cables. All cameras and domes shall be mounted with required housings for complete installation.

2.10 POWER SUPPLIES

A. INTERIOR 24 VAC POWER SUPPLY
   1. Input Voltage: 120VAC, 60 Hz
   2. Output Voltage: 28VAC, Fusing: 10A
   3. Input Connector: Line Cord
   4. Output Connector: Screw type barrier strip
   5. Rating: NEMA1
   6. 32 class 2 rated PTC protected power limited outputs

B. Acceptable Manufacturer:
   1. Altronix
   2. Approved Equal

END OF SECTION 285200

SECTION 285260 – VIDEO MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 WORK IN THIS SECTION:

A. A Video Management System (VMS) shall be provided to support all of the cameras in the facility.

B. This section includes the requirements and operational characteristics for a Video Management System, which is an integral part of the Security Control System. Video Management Systems included are:

1. Video Management System Servers
2. Video Storage equipment.
3. Client Computers.

C. Provide all labor, equipment, materials, licenses, and supervision to install, program, calibrate, adjust, document, and test the total system as required herein and on the drawings.

D. Provide documentation, as part of the submittal, indicating that the individuals installing the Video Management system have been trained and have installed this product prior to this project.

1.3 SYSTEM DESCRIPTION

A. Provide a Video Management System with the following system features and software requirements to allow for seamless control and future flexibility:

1. Integration of the VMS with the VGUI system to allow VGUI operators to provide manual camera call-up, automatic camera call-up (from active intercom call, duress alarm, etc.) and display of live video in a designated area on the VGUI monitors.
2. Digital video recording of all the cameras in the VMS system.
3. Configuration, viewing of recorded images, and ability to record incidents to DVD-R discs.
4. Video recording should be in a non-proprietary format such that no special program is required to view them.
5. Provision of client computers loaded with the VMS client software to perform the following operations;
   a. Live display of cameras
   b. Live display of camera sequences
   c. Control of PTZ cameras
   d. Playback of archived video
   e. Retrieval of archived video
   f. Instant replay of live video
   g. Use of procedures
   h. Configuration of system settings
   i. Execution of system macros

B. VGUI station shall have ability to call up camera views to a secondary monitor attached to the VGUI station. Camera selection for each VGUI shall be limited to that VGUI's control responsibilities.

C. The VMS software run on standard off-the-shelf computer server and communicating over Ethernet network using the TCP/IP network protocol. The proposed solution shall not require proprietary computer hardware. The proposed solution shall be based on Windows™ Server Operating System.

D. The VMS system shall be based on the latest in software programming technology and shall be based on Microsoft .NET frame work. The software shall be the latest and most current platform offered by the manufacturer.

E. The VMS system shall support both analog and IP cameras. Support of analog cameras shall be done using Camera Encoder Video Servers and shall not require the installation of video capture cards.

1. The VMS shall support both NTSC and PAL video formats.
2. The VMS shall support video both from analog and IP fixed color/B&W cameras, PTZ/Dome cameras, infrared cameras, X-Ray cameras, low light/IR cameras, and any other camera that provides a composite NTSC/PAL 1v p-p video signal.

F. The VMS shall support the H.264, JPEG, M-JPEG, MPEG-4, MPEG-2 video format simultaneously.

G. The VMS shall sustain full operation using VGA, HD and Megapixel video resolutions.

1. The VMS shall be able to support all cameras at the maximum frame rate and the maximum resolution while maintaining less than 80% load on the Server.

H. The VMS in addition to Video shall provide full Audio monitoring and recording functionality.

I. The VMS shall allow for 2-way audio communication using the audio interface

1. The VMS shall provide the ability to communicate back to an audio enabled Encoder, Decoder or IP camera and provide an IP based Intercom.

J. The VMS Audio function shall be available as independent sources and/or synchronized with video.

K. The VMS shall allow the use of audio inputs for Audio recording of telephone lines, microphones, radio systems or any other analog audio interface.

1. The VMS shall allow for audio search by date, time and alarm event with or without association to video.
2. The VMS Media Archive Server, for video and audio, shall be sized to support and manage all camera connection from IP cameras or video Encoders each at 30fps.

L. The VMS shall be based on the TCP/IP communication protocol between all IP cameras, Encoders, Decoders, Video Management Management Software and Media Archive Servers.

M. The VMS storage system shall be based on advanced recording methods and shall not rely on the Windows Operating System to manage the storage.

N. The VMS shall provide the coactivity to an external storage system. The VMS storage option as a minimum shall provide RAID-5 redundancy. All storage redundancy and mirroring capabilities shall be done using hardware interface and shall not rely on the Windows Operating System to perform these functions.

O. The VMS shall be based on high quality H.264 and/or MPEG-4 IP cameras.

P. The network based video recorder server (Media Archive Server) shall as a minimum provide multi-video compression support and shall simultaneously record video from H.264, MPEG-2, MPEG-4 video and JPEG and M-JPEG image compression algorithm standards. The VMS shall allow for specific camera to be set at the most optimized recording technique, H.264, MPEG-2, MPEG-4, J-PEG or M-JPEG, and should be available for live monitoring and recording signals. The system shall be flexible and as a minimum, the compression scheme shall be able to run in one of several bandwidth selections.

Q. The system shall allow the recording, live monitoring, playback of archived video audio, and data simultaneously. The VMS shall allow the user to view live video at 30 fps while recording at a lower frame rate for more efficient video storage.

R. The VMS client application shall support two flat panel monitors to be connected to a single computer.

S. Each monitor shall have independent controls and shall support multi views up to 16 real time camera views.

T. The VMS client application shall allow each user the ability to view 32 cameras on a single PC, all at 30fps.

1. The system shall maintain the capability to add additional flat panel monitors for other applications.

U. The VMS shall provide a reporting utility for tracking, including, but not limited to, the following options. Video and images shall be stored with reports for documenting events.

1. Alarms
2. Incidents
3. Operator logs
4. Service requests

V. The IP Based VMS shall provide a file export tool for export of single frames of video in J-PEG and BMP file formats and for export of motion video files in AVI file format for transport and playback on computers utilizing a Windows environment.

W. The VMS database and video storage shall be based on SQL Server. The VMS operating system shall be Microsoft Windows Server. The IP Based VMS shall allow for installation of Anti-Virus and network security Software. This shall be on a separate network.

X. The VMS shall be initially configured by the Security Control System Contractor, and coordinated with the Owner, to configure system parameters according to the operation of the facility, taking the needs of all cameras (down to an individual basis) into consideration.

Y. Acceptable Manufacturers:

1. Avigilon
2. Bosch
3. Exacq
4. Genetec
5. Hanwha
6. Milestone
7. Pelco

8. Vicon
9. Or Approved Equal

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Video Management System (VMS) Central Directory Server

1. General: The Directory Server shall store a centralized system database and manage the VMS and user security privileges.
2. VMS Server Software:
   a. The VMS software shall consist of an MS-SQL 2008 or better based Main Directory Database Server, Media Archive Server (audio and video), Digital Virtual Matrix, Incident Reports, Alarm Management, Network Management System and Watchdog modules.
   b. The VMS SQL based Database Server shall offer the capability to be installed on multiple servers to enable distributed architecture on the LAN or WAN.
   c. The VMS Database Servers hall not limit the number of Media Archive Servers which can be networked together to form a distributed video management and recording system.
   d. The VMS Database Server shall maintain a catalog of settings for all the client, servers, encoders, decoders and IP cameras in the system.
   e. The VMS Media Archive Server shall offer the capability to be installed multiple servers software on multiple Computer Servers to enable distributed archiving architecture on the LAN or WAN.
   f. The VMS shall record all video from all IP cameras, in the native video format of each (e.g. Mpeg-4, MPEG-2 or M-Jpeg video compressions).
   g. The VMS shall record all video in real time simultaneously at bandwidth ranging from 8 Kb/sec to 4 Mb/sec, frame rates ranging from 1fps to 30fps NTSC/25PAL and resolution ranging from CIF (352X240 NTSC) to 1080p HD (1920x1080 NTSC).
   h. The VMS shall be able to set each camera frame rate, bit rate and resolution independently from other cameras in the system, and altering these settings shall not affect the recording and display settings of other cameras.
   i. The VMS shall require no proprietary hardware for video and audio recording servers.
   j. The VMS shall not utilize any hardware or software multiplexer or time-division technology for video or audio recording and monitoring.
   k. The VMS shall provide a Redundant recording module for system redundancy.
   l. The VMS shall support a built-in Digital Video Matrix Switcher
   m. The VMS shall support an Internet Video Broadcast server (IVB).
   n. The VMS shall support video motion detection module.
   o. The VMS shall support a built-in Watchdog module.
   p. The VMS shall provide a full interconnectivity between analog matrix operations and IP video to analog and digital outputs. The VMS shall have the capacity for unlimited analog video inputs and outputs.
   q. The VMS shall have the capability to program each IP viewing station to view and control selected cameras only.

r. The VMS shall provide a Windows-based GUI (Graphical User Interface). The VMS shall provide operation on multiple VGA monitors connected to a single PC using standard hardware and software.
s. The VMS shall be based on a true open architecture that allow for use of industry standard PC and storage hardware that shall not limit the storage capacity and shall allow for gradual upgrades of recording capacity. The VMS shall digitally sign recorded video using 2048-bit RSA public/private key encryption. The VMS shall allow for changing the encryption key.
t. The VMS Shall support management and control over unlimited satellite sites.
u. The VMS shall provide alarm dry contact interfaces to allow for any alarm input initiating any action in the VMS system. The VMS shall provide a serial interface for alarm input to allow for any alarm input initiating any action in the VMS system.
v. The VMS Shall support full duplex audio communication and transmission signals over the IP Digital Transmission Network.
w. The VMS shall provide alarm management module.

3. VMS Central Directory Server Configuration (minimum requirements):
a. Dual Processor (x2) Intel Xeon ES-2660, 2.20GHz, 20M Cache, 8.0GT/s QPI, Turbo, 8C, 95W, Max Mem 1600MHz
b. Memory: 32GB: Two (2) 16GB RDIMM, 1600MT/s Low Volt, Dual Rank, x4 Data Width
c. Operating System: Windows Server 2016
d. Hard Drive Configuration: RAID 1, with discrete RAID Adapter with Battery Backup and 512MB NV Cache.
e. Hard Drives: Two (2) 250GB Solid State, SAS, SLC 6Gbps, 2.5", hot-pluggable
f. Power Supply: Redundant Power Supplies with separate power cables to connect to different circuits.
g. Network Adapter: On-Board Dual Port Gigabit Network Adapter
h. DVD 8X Optical Drive
i. 5 Years of Manufacturer Hardware Warranty with Critical Support Services (24x7x365 with 2-hour onsite response)
j. Approved manufacturers: Dell PowerEdge series, HP

B. Video Management System (VMS) Archiver Server

1. General: The Archiver Server shall operate the recording and playback of video, audio and meta-data. Provide required number of archiver servers to meet system requirements.

2. VMS Archiver Server Configuration (minimum requirements):
a. Dual Processor (x2) Intel Xeon ES-2660 2.20GHz, 20M Cache, 8.0GT/s QPI, Turbo, 8C, 95W, Max Mem 1600MHz
b. Memory: 32GB: Two (2) 16GB RDIMM, 1600MT/s Low Volt, Dual Rank, x4 Data Width
c. Operating System: Windows Server 2016
d. Hard Drive Configuration: RAID 1, with discrete RAID Adapter with Battery Backup and 512MB NV Cache.
e. Hard Drives: Two (2) 250GB Solid State, SAS, SLC 6Gbps, 2.5", hot-pluggable
f. Power Supply: Redundant Power Supplies with separate power cables to connect to different circuits.
g. Network Adapter: On-Board Dual Port Gigabit Network Adapter

h. DVD 8X Optical Drive
i. 5 Years of Manufacturer Hardware Warranty with Critical Support Services (24x7x365 with 2-hour onsite response)
j. Approved manufacturers: Dell PowerEdge series, HP

C. Video Storage Equipment

1. General: Direct attached disk storage enclosures shall be provided supporting multiple SAS drives for the storage of video files. The storage enclosures shall be attached to the VMS server(s) and shall be configured in a RAID 5 configuration. Sufficient disk storage shall be provided to provide video storage for all the cameras in the VMS system with the following configuration: All cameras being recorded continuously 24/7 at 7.5 images per second per camera without motion and at 15 ips on motion, recording at native resolution, with H.264 and/or MPEG-4 compression, assuming an activity level of 35% across all cameras and providing for a minimum of 30 days of storage. The system automatically replaces the oldest video stored when the system storage capacity is reached.

2. Provide multiple attached disk storage enclosures (as required for recording requirements) which meet the following specifications;
   a. PCI SAS RAID adapter for the VMS Archiver Server, for RAID 5
   b. Hot-pluggable SAS Drives (size and type based on calculated storage required)
   c. Storage Enclosure shall be configured for N+1 drives to ensure there is a hot, spare drive available
   d. Hard drive capacity: Up to twelve (12) hot-pluggable SAS Hard Disk Drives (HDDs) at 7200, 10K, and 15K rpm and SAS solid state
   e. Maximum capacity per enclosure: 48TB using twelve (12) 4TB 7,200 RPM 6Gb/s SAS drives
   f. Two (2) enclosure management modules
   g. Power Supply: Redundant Power Supplies with separate power cables to connect to different circuits.
   h. Approved manufacturer: Dell™ PowerVault™ MD1200 series with sufficient storage to meet the requirements as specified above.

D. Client Computers

1. General: VMS Client Computers shall be provided at locations as shown on the plans. Designated client computers shall provide the administrative user interface for the system, enabling the definition and configuration of various system aspects.

2. VMS Client Software
   a. The VMS client shall consist of Administrator Tool application, a Monitoring application, an Archive Player application, a Web Monitoring access, a Web Archive Player access and a Mobile Monitor application.
   b. The VMS client shall perform the following applications simultaneously without interfering with any of the Archive Server operations (Recording, Alarms, etc.): live display of cameras, live display of camera sequences, control of PTZ cameras, playback of archived video, retrieval of archived video, instant replay of live video, use of procedures (Macros), configuration of system settings, execution of system macros.
   c. The VMS client applications shall support any form of IP network connectivity, including: LAN, WAN, VPN, Internet, and Wireless (WiFi and Cellular) technologies.

d. The VMS client applications shall support IP Multicast (UDP) and Unicast (TCP or UDP) video streaming. The VMS client applications shall automatically adapt to the network topology and use the best available method to receive streaming video.
e. The VMS client applications shall provide an authentication mechanism, which verifies the validity of the user.
f. The Client Monitor application shall allow for live monitoring of video and audio.
g. The VMS Monitor application shall allow operators to view an instant replay of any camera.
h. The VMS Monitor application shall allow operators to add bookmarks or to switch their instant replay view into the Archive Player application, for advanced operations, by clicking on a single button in the Instant Replay tab.
i. The VMS Monitor application shall provide management and control over the system using a standard PC mouse, keyboard and VMS keyboard.
j. The VMS Monitor application shall display all cameras attached to the system regardless of their physical location on the network.
k. The VMS Monitor application shall display all camera sequences created in the system. The VMS Monitor application shall allow for unlimited cameras sequences, which can be run independently of each other on either digital VGA monitor tiles or analog VMS monitors.
l. The VMS Monitor application shall allow operators to control (Pause/Play, skip forwards, skip backwards) Camera Sequences, without affecting other operators' ability to view and control the same sequence.
m. The VMS Monitor application shall display all cameras, sequences and analog monitors in a logical tree. The VMS Monitor application operator shall be able to drag and drop a camera from a tree of available cameras into any video tile or an analog monitor icon for live viewing. The VMS Monitor application operator shall be able to drag and drop a camera sequence from a tree of cameras into any video tile or an analog monitor icon for live viewing.
n. The VMS Monitor application shall support the procedure functionality, where procedures can be triggered to appear during a certain event & can be used to provide detail written or verbal instructions to the operator as to the actions to be taken.
o. The VMS Monitor application shall support digital zoom on a fixed camera's live video streams. The VMS Monitor application shall support digital zoom on a PTZ camera's live video streams.
p. Each workstation running the IP Based VMS client application shall be able to use a VMS keyboard that can control the entire set of cameras throughout the system, even if the system consists of motorized cameras produced by different manufacturers.
q. The VMS shall support full control for PTZ (Pan Tilt and Zoom) cameras.

3. Client Workstation with keyboard & mouse shall consist of an Intel Core i5-4570 quad core, 3.2GHz turbo processor or better Computer with 512K cache, 8GB 1600MHz DD3 Memory, 250GB hard drive, 2 USB ports, network card for Ethernet operation, CD-ROM drive, sound card, video accelerator, running Windows 10 Pro. Provide UPS power for all workstations.
4. Approved manufacturers:
   a. Dell
   b. HP

5. Approved client software manufacturer:
   a. Avigilon
   b. Bosch
   c. Exacq
   d. Genetec
   e. Hanwha
   f. Milestone
   g. Pelco
   h. Vicon
   i. Or Approved Equal

E. Accessories:
   1. Provide one or more KVM switches sized for the number of Video Management System servers in the system. Approved KVM switches: Tripp Lite. Provide KVM Switch cable kits as required.
   2. Provide 1U Rack Mount LCD monitor keyboard drawer with 19" TFT, keyboard and touch pad equal to Acnodes Model KD8190 or approved equal.
   3. Provide multiple 24-port 10/100/1000 BASE-TX Fast Ethernet managed stackable rack-mountable switches with 2 mini GBIC ports.

F. Spares:
   1. Refer to Section 285000.

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

A. The Security Control System Contractor shall provide a block-switching table that incorporates all requirements of the intercom, video call up and alarming specified in all other sections of this division. The Owner shall maintain the right to request modifications at any time during the warranty period at no charge.

3.2 EXAMINATION

A. Verify that surfaces and areas are ready to receive work. Verify field measurements are as shown on Drawings and as instructed by manufacturer. Verify that required utilities are available, in proper location, and ready for use.

3.3 INSTALLATION

A. Field testing and inspection will be performed under the provisions of Section 285000.

B. Replace equipment, components, and wiring as required, achieving a fully functional system.

3.4 COMMISSIONING

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, programming, troubleshooting, servicing, and preventative maintenance of the system. Schedule training with Owner through the Architect, with at least seven days notice.

END OF SECTION 285260

SECTION 285300 – ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 SUMMARY

A. Provide and install as shown on the Drawings and herein specified a complete and operable Access Control System. Readers shall consist of proximity readers, proximity reader/keypads, and other access control system devices. Upon correctly entering a personal ID code or presenting a proximity card / keyfob, the system shall grant access to a controlled device or resource

B. Provide Isonas system from Allegion to stay consistent with Owner standard.

C. System shall be independent of any existing card access systems. Coordinate with the owner all the card, keyfob or other credential types being used by the owner and provide a system that will work with those existing credentials.

D. The Access Control System shall be installed in accordance with all applicable NEC, and local building codes. All equipment shall be UL labeled. All equipment shall be compatible

E. The Access Control System shall interface to the Fire Alarm System as required to meet all required Fire and Life Safety Codes

F. The system shall use Mercury boards for the hardware control with the OSDP platform.

G. The system shall include, but not be limited to, the following
   1. Proximity card readers
   2. Proximity card & keypad combo readers
   3. Control Processors
   4. Alarm monitoring modules
   5. Output relay modules
   6. Access control proximity cards & key fobs
   7. PC running the Card Access System's Software
   8. All required licenses to function completely and expand 25%.
   9. I.D. Photo Access Cards with identification images and logos
   10. Support Biometric readers
   11. Support Magnetic stripe card readers
   12. Support keypads & pin pads

H. Provide archive/purge and backup utilities for database maintenance.

I. The Access Control System's database shall be fully integrated with the database of the Security Management Server (SMS), allowing the token user's Name, not ID code, to be logged by the SMS upon any use of a token reader. The system shall log all access control events, including access granted, access denied, and duress codes used. All access control events shall be

associated with the token user's Name. Provide secure lock operation and maintain audit trail, even when the server or the network is unavailable.

J. The Access Control System's database shall be capable of a minimum of 5,000 user accounts. The Access Control System shall be capable of supporting 100 client licenses. Access Control system database shall be Microsoft SQL 2008 or better.

K. The Access Control System shall be a robust, user-friendly, easily expandable solution. Users shall be added, modified, and deactivated using a Windows-based GUI interface. Each user shall be given customized access rights to controlled devices and other resources based on the time of day, day of the week, and restricted dates. In addition, users must be able to be assigned to customized user groups, which system administrators shall be able to create in order to streamline the access management process and tailor it to their own needs.

L. The Access Control System shall integrate seamlessly with the Security Control System to visually alert operators when a door has been accessed via the reader system and shall allow VGUI operators to isolate (disable) individual readers to prevent access. The SMS shall be able to log requests at doors with an isolated reader. Users shall be capable of entering Duress Codes at proximity reader/keypads, which shall activate a duress alarm at that location on one or more VGUI's. The same level of integration shall also be seen on the SMS, which shall record the user's Name and time when a resource is accessed and shall include a full range of reporting features. Login to the Access Control software shall be password protected and access shall be logged to the SMS.

M. The access system shall not directly open any doors. It shall make door open requests of the PLC System. The PLC System shall verify interlocking of the requested door and status of the reader prior to any unlocking.

N. The system shall also have a fully integrated, Windows-based help system. The system shall also have context sensitive help.

O. The system shall have a lockout feature after an invalid access code has been entered four times on a keypad.

P. The system shall be programmable with a master code so that access can be granted through a card reader/keypad combo device with only the master keypad code and no proximity card.

Q. Provide hardware and software as a single integrated application for all of the following:

1. Online locks that are programmed and controlled via a central computer which communicates via the network to controllers which are then wired to the individual door locations.

2. Offline locks which may become disconnected from a central computer system, but are managed and programmed by the same software application.

1.3 CARD ACCESS CLIENT VIEWING STATION COMPUTER:

A. Central Equipment: Provide a Client station with Card Enrollment equipment as indicated on the drawings. All central equipment power shall be provided from emergency circuits. Additional UPS or Battery Backup power shall be provided for all central equipment to provide error free operation. Central equipment shall include but not be limited to the following:

1. Intelligent Controller: Supports up minimum of 8 readers. Firmware for 10,000 cardholder records and 1,000 transactions. Shall support both proximity readers and keypads

simultaneously for each door. Systems shall be capable of optionally supporting LAN or WAN communications using TCP/IP.

2. Access Control Software shall operate on Windows 10 or better. Software shall include Administration, Event Monitoring, Status Windows, and multiple application windows open simultaneously, Software shall also include the following.

1.4 SOFTWARE FEATURES

A. User Configuration Functions: A user shall include any individual that uses the access control system to access resources, such as a door, software application, or VGUI. A user shall also include an administrator who is using the access client software to add users and set permissions and rules. User configuration functions shall include the following:

1. Creating a New User
    a. Provide a User Configuration screen that shall allow the operator to create a new user or display information about current users. The information fields displayed shall include the following; Last Name, First Name, Middle Name and ID Number. The ID Number shall be any combination of letters and numbers up to a maximum of 50 characters
    b. Optionally, a User Type shall be capable of being selected: Types shall include (None), Staff, and Visitor. A user type of Inmate or Staff must be selected when using the work release or time and attendance tracking features respectively
    c. Any custom user information shall be capable of being entered into the Additional Information tab
    d. An image shall be capable of being associated with a user and stored in the SMS database for retrieval from the client software or VGUI(s)
2. Modifying a User (Searching)
    a. Provide a means to modify information about existing users
    b. Provide a User Search dialog box that, by default, displays all active users in the database. The User Configuration screen for each user shall be displayed upon the selection of a user in the database
    c. Provide a means to facilitate a more refined search. The operator shall be capable of selecting a field (i.e. – Last Name, First Name, ID Number, token, etc.) to search on in a "Search" list and typing the desired text in a "For" box. The operator shall also be capable of searching for deactivated accounts by means of a checkbox selection
3. Acquiring an Image for a User
    a. Provide a means to capture an image and associate it with an individual user in the database
    b. Provide an Image Acquire screen that shall allow an operator to capture an image via an image capture device (i.e. – USB camera). Provide a drop-down list of available image capture devices
    c. Provide a preview window that displays a live video stream. Depending upon the options available for the selected image capture device, provide Format, Source, Compression, and Display buttons to allow the operator to fine-tune the video stream
    d. Provide an Image Capture button for the operator to select once the user is positioned properly in the preview window. Once selected, the image shall appear in a separate user image window. Provide a means to assign the captured image to the user

4. Importing an Image for a User
    a. Provide a means to import an image and associate it with an individual user in the database
    b. Provide an Import Image screen that shall allow an operator to import an existing image. Provide a window for the operator to browse to an existing image and open the image once it is found
    c. Provide an outlined area (or box) showing the size of the user image window. If the imported image is larger than the user image window, the operator shall be able to relocate the image box by holding down the left mouse button and dragging the box to the desired location within the image. Provide a means to assign the imported image to the user
5. Assigning Permissions to a User
    a. Provide a means to allow users access to system resources
    b. Provide an Assign Permissions tab within the User Configuration screen. This screen shall show a list of all system resources. Each resource shall include a checkbox to allow access to that particular resource. Provide a "filter" box with drop down menu to allow the operator to select and display a particular type of resource. Resource types shall include, but not be limited to, the following; Doors, VGUI's, Access Control System Client software, SMS client, etc
    c. Provide Check All and Uncheck All buttons for the operator to select to simplify the assignment of permissions
6. Assigning a User to User Groups
    a. Provide a means to allow users to be assigned to User Groups. A User Group shall be defined as a specific group of users who share the same permissions and rules. When a user is assigned to a group, they shall receive the same permissions and rules that the group has, in addition to their own individual permissions and rules. Users shall be capable of belonging to more than one user group
    b. Provide an Assign Groups tab within the User Configuration screen. This screen shall show a list of all user groups in the system. Each group shall include a checkbox to assign the user to that particular group
7. Assigning Rules to a User
    a. Provide a means to assign rules to a user. Assigning rules to a user shall allow the user's permissions to be restricted to specific days of the week, as well as specific times of the day. Provide a means to have a user's access to activate or expire on a specific day or prevent them from using permissions on restricted dates
    b. Provide an Assign Rules tab within the User Configuration screen. Provide an 'Allow access only on selected days of the week' checkbox for users that are allowed access only on specific day(s). Provide checkboxes for each day of the week for the operator to select for days they want the user to have access on
    c. Provide an 'Allow access only during time range' checkbox for users that are allowed access only during specific times. Provide time configuration boxes for 'No earlier than' and 'No later than' that include the time in hours, minutes and seconds. Provide indications for "AM" and "PM"
    d. Provide an 'Unrestricted Access' checkbox to select for users that have no access restrictions based on the time of the day and the day of the week
    e. Provide an 'Access has activation date' checkbox for users that have permissions that should not begin until a later date. Provide a drop-down calendar tool to set the activation date

f. Provide an 'Access has expiration date' checkbox for users that have permissions that should expire on a certain date. Provide a drop-down calendar tool to set the expiration date
g. Provide an 'Allow access on restricted dates' checkbox for users that are allowed access on restricted dates

8. Assigning Tokens to a User
   a. Provide a means to assign tokens to a user. Assigning Tokens to a user consists of assigning items such as a PIN code, Duress Code, proximity card number, password, etc. that the Access Control System uses to identify a user
   b. Provide an Assign Tokens tab within the User Configuration screen. All tokens assigned to a particular user shall be displayed on this tab
   c. Provide information fields for the following tokens: Proximity Card, Personal Identification Number, Duress Code and User Name and Password
   d. Provide a Proximity Card field that shall be used to assign a proximity card or keyfob ID number to the user. For this feature, a proximity reader enrollment station may be used. The operator shall activate an Enroll button and swipe a proximity card or keyfob at the enrollment reader. The proximity ID will appear in the field when the card or keyfob is read
   e. Provide a Personal Identification Number field that shall be used to assign a unique number to a user for use with proximity readers with a keypad option. Upon correct entry of a personal identification number at a keypad, the user shall be granted access to the resource. The personal identification number shall be up to a maximum of 12 digits long, and unique for all users
   f. Provide a Duress Code field that shall be used to assign a unique number to a user for use with proximity readers with a keypad option. Upon correct entry of a duress code at a keypad, the local and Central Control VGUI(s) shall be notified that a duress alarm exists. The duress code shall be a maximum of 13 digits long
   g. Provide User Name and Password fields that shall be used to assign a unique user name and corresponding password for the purpose of accessing VGUI's and the access control system client software
   h. Provide for a replacement card to automatically invalidate the user's previous lost card
9. Creating a New User Group
   a. Provide a means to create User Groups, which shall allow the operator to easily assign the same permissions and rules to many users
   b. Provide a Group Configuration screen that shall allow the operator to create a new group or display information about current groups. The information fields displayed shall include the following; Group Name
10. Modifying a User Group (Searching)
   a. Provide a means to modify information about existing user groups
   b. Provide a User Group Search dialog box that, by default, displays all active user groups in the database. The User Group Configuration screen for each user group shall be displayed upon the selection of a user group in the database
   c. Provide a means to facilitate a more refined search. The operator shall be capable of selecting a field (i.e. – Group Name, Resource Type, Resource Name) to search on in a "Search" list and typing the desired text in a "For" box
11. Assigning Permissions to a User Group
   a. Provide a means to allow user groups access to system resources

b. Provide an Assign Permissions tab within the User Group Configuration screen. This screen shall show a list of all system resources. Each resource shall include a checkbox to allow access to that particular resource. Provide a "filter" box with drop down menu to allow the operator to select and display a particular type of resource. Resource types shall include, but not be limited to, the following; Doors, VGUI's, Access Control System Client software, SMS client, etc
c. Provide Check All and Uncheck All buttons for the operator to select to simplify the assignment of permissions

12. Assigning Rules to a User Group
    a. Provide a means to assign rules to user groups. Assigning rules to a user group shall allow the user group's permissions to be restricted to specific days of the week, as well as specific times of the day. Provide a means to have a user group's access to activate or expire on a specific day or prevent the group from using permissions on restricted dates
    b. Provide an Assign Rules tab within the User Group Configuration screen. Provide an 'Allow access only on selected days of the week' checkbox for user groups that are allowed access only on specific day(s). Provide checkboxes for each day of the week for the operator to select for days they want the user group to have access on
    c. Provide an 'Allow access only during time range' checkbox for user groups that are allowed access only during specific times. Provide time configuration boxes for 'No earlier than' and 'No later than' that include the time in hours, minutes and seconds. Provide indications for "AM" and "PM"
    d. Provide an 'Unrestricted Access' checkbox to select for user groups that have no access restrictions based on the time of the day and the day of the week
    e. Provide an 'Access has activation date' checkbox for user groups that have permissions that should not begin until a later date. Provide a drop-down calendar tool to set the activation date
    f. Provide an 'Access has expiration date' checkbox for user groups that have permissions that should expire on a certain date. Provide a drop-down calendar tool to set the expiration date
    g. Provide an 'Allow access on restricted dates' checkbox for user groups that are allowed access on restricted dates
13. Assigning Users to a User Group
    a. Provide a means to assign users to user groups. When a user is assigned to a user group, they receive the permissions and rules of the user group in addition to their own rules and permissions
    b. Provide an Assign Users tab within the User Group Configuration screen. Each user in the database shall be displayed. Each user shall include a checkbox to assign the user to that particular group

B. Administrative Configuration Functions: Provide administrative-level tools to enhance and customize the functionality of the access control system software
    1. Adding/Modifying/Deleting User Information Types
        a. Provide a User Information Type screen that shall allow the administrator to create new, modify existing, or delete existing information fields for users. Information types (i.e. – address, phone number, etc.) shall be defined by the administrator on this screen. The administrator shall be capable of assigning a display order for each information field. A minimum of 1000 administrator-definable user information types shall be available

b. Once defined, these fields shall be displayed in the User Configuration screen. Provide an Additional Information tab within the User Configuration screen. All additional information specific to a particular user shall be displayed on this tab

2. Adding/Modifying/Deleting Restricted Dates
   a. Provide a Restricted Dates screen that shall allow the administrator to create new, modify existing, or delete existing restricted dates. Restricted Dates shall be used to control access on Holidays or other user-defined dates. Restricted dates shall be defined by the administrator on this screen. The administrator shall be capable of assigning a name, as well as a date for the restricted date on this screen. A minimum of 1000 administrator-definable restricted dates shall be available
   b. Once defined, access on restricted dates shall granted by going to the Assign Rules tab within the User Configuration screen, and checking the 'Allow access on restricted dates' checkbox
3. Reporting Features: The access system shall have the following reporting features
   a. User Profile Report: This report shall provide information in a document format on the user, such as full name, ID Number, and whether the account is activated or deactivated. This report shall also detail what group(s) the user belongs to, as well as what resources the user has permission to access. The rules for the user shall also be listed in the User Profile Report
   b. Resource Report: This report shall provide information in a document format on a particular resource. This report shall detail the specific resource chosen, as well as what group and user permissions are assigned to the resource
   c. Audit trail available historically or in real time, including standard reports that include, but not limited to:
      1) Invalid access attempts
      2) Time and attendance
      3) Door reader location
      4) Group of readers
      5) Individual cardholder
      6) Operator console activity
      7) History report for an alarm point(s) of state. An alarm point state shall be defined as: Normal, alarm, Trouble, Ajar
      8) History report for card state. A card state shall be defined as: Normal, Trace, Not Found, Anti-Pass violation, Time Zone Violation, Site Code violation or Expired card
   d. Ability to design custom reports

4. System Backup/Restore: The access system shall have the following administration features
   a. Database Backup: This tool shall provide a database management window, which shall allow the database files to be backed up to another directory or external media
   b. Database Restore: This tool shall provide a database management window, which shall allow the database files to be restored from another directory or external media
   c. Provide automatic backup procedure daily.
5. Badge Designer: The system shall have the following Badge Designer features

a. Badge Designer Basics: This tool shall be used to create custom badge templates. A badge template can then be assigned to any number of users in order to print custom user badges. The badge designer shall be capable of creating templates for use with badges with similar requirements
b. Badge Printing: This tool shall be used to allow for edge-to-edge card printing

6. Software shall have ability to partition control of the system by user ID.
   a. Allow multiple administrators with partition control.
   b. Allow a minimum of four administrators with ability to create security levels per operator.
   c. The cardholder database must be shareable across partitions.
   d. Must be able to create cardholders that are only accessible from a single partition.
   e. Hardware components (locks, readers, controllers, etc.) must be able to be assigned to a particular partition or shared across multiple partitions.
7. The system shall automatically adjust the time of the system for Daylight Savings changes.
8. The system shall cause an alarm when controllers go off-line.

1.5 SUBMITTALS

A. Refer to Section 285000 for submittal requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Isonas (Allegion)

2.2 ACCESS CONTROL SYSTEM (FILE) SERVER / CARD ACCESS CLIENT STATION COMPUTER

A. Provide a ACS File Server, Card Enrollment equipment and Client stations as indicated. This file server shall be permanently connected to PLC via Ethernet. File Server and Client Station computers shall include but not be limited to the following:
   1. Access Control Software shall operate on Windows 10 or better. Software shall include Administration, Event Monitoring, Status Windows, and support multiple application windows open simultaneously.
   2. The PC-based workstations shall consist of an Intel Core i5-4570 quad core, 3.2GHz turbo processor or better, 512K cache, 8GB 1600MHz DD3 Memory, 250GB hard drive, 2 USB ports, network card for Ethernet operation, CD-ROM drive, sound card, video accelerator, running Windows 10 pro. Provide UPS power for all workstations.
   3. This spec shall be exceeded as necessary when multiple systems are combined onto one station.
   4. Approved Manufacturers:
      a. HP
      b. Dell
B. Provide at Access Control System station a 24" or larger LCD flat panel monitor with 1280 X 1024 resolution unless otherwise noted.
   1. Approved Manufacturers – Dell, Samsung, NEC, HP

2.3 MATERIALS

A. Central Equipment
1. All components used in creating the access control system shall be of the same manufacturer and/or approved by the manufacturer for system compatibility. All control boards shall be built by Mercury Security OR Mercury Security series 3 using OSDP V2 communications. Used products shall not be acceptable. Equipment specified herein indicates the types of equipment and the minimum quality of equipment required. It shall be the SCSC's responsibility to assure the compatibility of all access control equipment, software, programming, cable, mounting methods, etc. that are used in providing a complete, fully-functional system.
2. All central equipment power shall be provided from emergency circuits. Additional UPS or Battery Backup power shall be provided for all central equipment to provide error free operation.
3. Intelligent Controller: Supports up minimum of 8 readers. Firmware for 10,000 cardholder records and 1,000 transactions. Shall support both proximity readers and keypads simultaneously for each door. Systems shall be capable of optionally supporting LAN or WAN communications using TCP/IP.

B. Proximity Reader
1. Coordinate mounting to be 48" AFF or less and to avoid issues with trim or other devices.
2. Dimensions: 3.3" x 4.8" x .95"
3. Power Supply: 5-12 VDC
4. Current Requirements: Average – 50/75mA (12VDC)
5. Communications: OSDP V2
6. Operating Temperature: -40° to 150°F (-40° to 65°C)
7. Operating humidity: 5-95% relative humidity, non-condensing
8. Transmit and Excite Frequency: 125kHz and 13.56MHz
9. The proximity reader shall be a HID Corp. model RP40 OR HID multiCLASS SE-RP40, BlueDiamond LNL-R10320-05TB, or approved equal
10. The proximity reader shall be a HID Corp. model RP10 OR HID multiCLASS SE-RP10, BlueDiamond LNL-R10330-05TB, or approved equal when mounted to Mullions or other

C. Proximity Reader/Keypad
1. Dimensions: 3.3" x 4.8" x .95"
2. Power Supply: 5-12 VDC
3. Current Requirements: Average – 50/75mA (12VDC)
4. Communications: OSDP V2
5. Operating Temperature: -40° to 150°F (-40° to 65°C)
6. Operating humidity: 5-95% relative humidity, non-condensing
7. Transmit and Excite Frequency: 125kHz and 13.56MHz
8. The unit shall include an integrated weatherized keypad.
9. The proximity reader/keypad shall be a HID Corp. model RPK40 OR HID multiCLASS SE-RPK40, BlueDiamond LNL-R10325-05TB, or approved equal

D. Proximity Keyfob
1. Dimensions: 1.90" x 0.900" x 0.550"
2. Construction: Ultrasonically welded, ABS shell

3. Operating Temperature: -50° to 160°F (-45° to 70°C)
4. Read range: up to 3"
5. Format: Shall support formats up to 85 bits.
6. The proximity keyfob shall be a HID model 1346 series.
7. Provide 150 keyfobs to the Owner upon final completion.

E. Printable Proximity Access Card

1. Dimensions: 2.125" x 3.375" x 0.033"
2. Construction: Thin, flexible polyvinyl chloride (PVC) laminate
3. Operating Temperature: -50° to 160°F (-45° to 70°C)
4. Read range: up to 7"
5. Format: Shall support formats up to 85 bits.
6. Options: Card shall include external card numbering, vertical slot punch and artwork gloss finish.
7. The proximity access card shall be a HID model 1386-LGSMV.
8. Provide 400 cards to the Owner upon final completion.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Check location, "roughing in", and field dimensions prior to beginning work.

B. Do not begin installation until all unsatisfactory conditions have been corrected.

C. Verify field measurements are as shown on Drawings and as instructed by manufacturer.

D. Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION/APPLICATION OF ALL SECURITY PRODUCTS:

A. Field testing and inspection will be performed under the provisions of Section 285000.

B. Replace equipment, components, & wiring as required to achieve a fully functional system

END OF SECTION 285300

SECTION 285400 – DURESS - MISC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 SUMMARY

A. This section includes the requirements and operational characteristics for duress and other miscellaneous systems, which are an integral part of the Security Control System.

B. Provide all labor, equipment, materials, and supervision to install, program, calibrate, adjust, document, and test the total system as required herein and on the Drawings.

1.3 SYSTEM DESCRIPTION

A. Duress: Provide duress pushbutton stations as indicated on the Drawings. Each duress location shall annunciate separately at the VGUI control station in control and Central Control. Duress buttons at VGUI control stations shall lock down the VGUI controls when that duress is activated.

B. Door Release Pushbuttons (PB): Provide pushbutton stations as indicated on the Drawings. Each location shall be an input to the PLC for verification and a request to unlock the door. PLC makes decision to open door or not. These buttons are not hardwired to the lock.

C. Request-to-Exit Devices (REX): Request-to-Exit devices are provided by Div 8 on all controlled Div 8 doors. SCSC shall coordinate and integrate with REX devices to shunt door alarm when door is exited. The only time a REX shall be programmed to unlock a door is if the door lacks any free egress hardware.

D. Acoustic Glass Break Sensor: Provide acoustic glass break sensors as indicated on the Drawings. Each location shall be an input to the PLC for annunciation at each VGUI control station.

E. Walk-Through Metal Detectors (Magnetometers) and X-Ray Unit: Provide as indicated on the Contract Documents.

1.4 SYSTEM FEATURES AND SOFTWARE REQUIREMENTS

A. Duress Alarms

1. Duress pushbutton stations shall be located in specific areas of the facility for the officers to press. Input and output signals from/to these stations shall be connected to the input and output modules of the PLC System.
2. All duress alarms shall be annunciated on the VGUI control station. The owner shall have the option of duress alarms annunciating on all VGUI control stations at no additional cost.
3. Duress stations are normally hidden on the VGUI control station(s). They shall be displayed during an alarm condition only.
4. Upon activation of a duress alarm, the audible alarm shall continually annunciate "DURESS" until the VGUI control station is SILENCED. The Site Plan shall flash in red the area in which the duress occurred to allow quick identification for the operator to

select that screen. The audio output from the nearest intercom station shall automatically be broadcast through the VGUI control station speakers. The local VMS camera video shall be displayed on the video call-up monitor in Central Control.

5. When the area of the alarm is shown full screen, the duress icon shall flash in red at a rate of one time per second at the location of the active duress station. Multiple duress stations will be shown individually, but shall only require one silent activation. When duress pushbutton stations with illuminated mushroom head pushbuttons are used, the lamp (activated by a PLC output) in the station will flash at a rate of one time per second once activated. Deactivating the duress at the station will not cancel the alarm at the VGUI control station. The duress pushbutton station lamp will become solid once the VGUI control station has SILENCED the alarm to alert the officer in duress that the duress alarm has been recognized.
6. When the local VGUI control station presses RESET, the icon shall become solid red. The duress situation will only be canceled once the remote station has been deactivated and the VGUI control station has RESET the alarm condition. Multiple duress stations must be individually RESET.
7. All duress alarms originating from duress pushbutton stations shall only be able to be reset at the physical duress pushbutton station location, requiring direct intervention of the staff. The VGUI control station shall only be able to silence the alarm annunciation.

B. Miscellaneous Systems

1. Door Release Pushbutton (PB):
   a. Activation of an exit pushbutton station shall request that the associated door be opened via the PLC System.
   b. The pushbutton shall not be wired directly to the associated door's electrically powered lock, but to an input point of the PLC System. Activation of the pushbutton shall take into account all interlocking with other doors and shall not create a 'Breached Door' alarm.
2. Request-to-Exit (REX) devices: Shall provide an input signal to the PLC system to:
   a. Shunt door alarms when exiting the door via free egress hardware.
   b. Unlock door and shunt alarm for doors without free egress hardware.

C. Alarm Dialer

1. Alarms associated with the Touchscreens that are generated when the touchscreen is logged off (after hours) shall be sent as recorded messages via an alarm dialer to the number(s) provided by the Owner (default to 911 otherwise).

PART 2 - PRODUCTS

2.1 Duress Pushbutton Station, Wall-mounted Mushroom Head

A. Provide an Allen-Bradley 800-T series, illuminated, mushroom head, latching pushbutton mounted to a single-gang faceplate of 12-gauge stainless steel for all wall-mount applications. The text "DURESS" shall be laser-engraved on the faceplate.

B. Approved equal manufacturer: General Electric.

2.2 Duress Pushbutton Station, Under-Counter

A. The unit shall include double-pole, double-throw contacts.

B. The unit shall be supplied with a lock-mounted switch and one key.

C. The unit shall be designed for silent operation and housed in a stainless steel housing.

D. For under-counter duress pushbutton stations, provide a single gang box mounted at 18" AFF with 3/8" center hole coverplate and allow 6' of flexible connection to underside of desk. Use cable tie base fasteners screwed to the walls and underside of the counter or desk. Coordinate exact placement at desks and counters with Owner.

E. Approved Manufacturer:
   1. Amseco Husk 20
   2. Honeywell 269R
   3. Approved equal.

2.3 Door Release Pushbutton, Wall (PB):

A. The switch shall be a momentary, pushbutton, dry contact type that is moisture and damage proof. The contacts shall be rated at three amperes, 300 watts AC with a non-inductive load. It shall be a single pole, single throw momentary action switch, attached to the faceplate from the rear so that it cannot be removed when installed.

B. The pushbutton shall be captive within the faceplate. It shall be constructed so that it does not provide a permanent closure or call-in indication when operated. The switch shall be mounted on a single-gang faceplate of 12-gauge stainless steel. The text "DOOR RELEASE" shall be laser-engraved on the faceplate.

C. Approved Manufacturer:
   1. Harding
   2. Southern Folger
   3. Quam
   4. Approved equal

2.4 Door Release Pushbutton, Under-Counter (PB):

A. The unit shall include double-pole, double-throw contacts.

B. The unit shall both look and function different from the under counter duress push button.

C. For under-counter duress pushbutton stations, provide a single gang box mounted at 18" AFF with 3/8" center hole coverplate and allow 6' of flexible connection to underside of desk. Use cable tie base fasteners screwed to the walls and underside of the counter or desk. Coordinate exact placement at desks and counters with Owner.

D. Approved Manufacturer:
   1. USP HUB2SA
   2. Approved equal.

2.5 Acoustic Glass Break Sensor

A. The sensor shall include the following characteristics:
   1. Operational voltage: 9-16 VDC, 25mA max.

2. Relay output: Normally closed, open 4 seconds on alarm
3. Maximum loop rating: 16 VDC, 50mA
4. Operational temperature: 0°F to 120°F (-18°C to +50°C)
5. Microphone: Omni-directional 360° electrets
6. Range: 25' measured to the farthest point of glass, 25' on the opposite wall, 20' measured to the wall
7. Minimum distance from glass: 3.3'
8. Glass types detected: Plate, tempered, wired or laminated glass – up to ¼"

B. Acceptable Manufacutrers:
1. Interlogix (Sentrol) 5820A
2. Honeywell FG1625RFM
3. Ademco 2520FM
4. Approved equal

2.6 Alarm Dialer

A. SCSC shall use a dialer that is compatible with the security system and interfaces with PLC for alarm notifications.

B. Minimum requirements:
1. Work on Analog phone line (Digital and IP are acceptable)
2. Receive and broadcast at least 8 or more alarm messages/inputs
3. Dial at least 8 or more phone numbers
4. Basis of Design is Viking K-2000-DVA or equivalent

C. Coordinate alarms/messages with the Owner during the touchscreen Phase meetings. As a basis for design provide:
1. Duress alarms – Judges
2. Duress alarms – Admin
3. Glass break alarm – Judges
4. Glass break alarm – Admin
5. Glass break alarm – Public
6. Door alarm – Judges
7. Door alarm – Admin
8. Door alarm – Public (Entrances)

D. Coordinate Telco connection in Data room

2.7 Walk-Through Metal Detector:

A. Series/Manufacturer:
1. Checkgate MZ-8 / Auto Clear
2. CheckGate 9800 / Auto Clear
3. PD 6500i / L-3 Communications
4. HI-PE / CEIA USA
5. SMD600 MZ / Smiths Detection

B. Function:

1. Walk-through detector.
2. Minimum false alarming due to adjacent X-ray units, radio frequency, and electromagnetic interference.
3. Provide built-in control console to indicate alarms, settings, and status of the metal detector.
4. Metal detector shall be designed to operate in a temperature range of 0° C to 55° C and up to 100% humidity.
5. Power requirement: 115 VAC, 60 Hz.
6. Provide necessary auxiliary equipment and items necessary for a complete, fully-functional installation.

2.8 X-Ray Machine:

A. Series/ Manufacturer:

1. Linescan 215 Series / L-3 Communications
2. HI-SCAN 6046si / Smiths Detection
3. 6848 X-Ray Inspection System / Auto Clear

NOTE: Other manufacturers must submit pre-bid product information on their proposed model equivalents for approval at least 15 days prior to bid date.

B. Function:

1. Tunnel opening of 18" high by 24" wide.
2. High resolution color monitor, 17"
3. At least 20 levels visible as measured by a stepwedge.
4. Minimum 25mm steel penetration.
5. Dose per inspections, 0.05m R typical.
6. Compliant with all health and safety standards.
7. Power, 105-125 VAC, 60 Hz (15 amp max)
8. Conveyor speed, 0.23m per sec (45 feet per min)
9. Conveyor belt length, 113.6 inches.
10. Conveyor capacity, minimum 150 pounds.

END OF SECTION 285400

SECTION 285500 – AUXILIARY CONTROL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 SUMMARY

A. Auxiliary control systems shall include remote control of lighting and water control.

B. Division 22 contractor to provide solenoid valves to interface with the security control system to allow all water to be shut off at each holding cell. SCSC is responsible for conduit and cabling to these solenoid valves and the dry contact outputs to interface with the valves. Provide required interface to shutoff all water at each holding cell, via the security control VGUI(s).

C. Division 26 contractor shall provide relay enclosures and relays for all lighting control interfaces. SCSC is responsible for conduit and cabling to these panels and the dry contact outputs to interface with the relays. Coordinate all requirements with Division 26 contractor during the submittal coordination meeting as described in Section 285000. All lighting switch legs shall be wired by the Division 26 contractor.

D. The lighting control system shall provide for remote switching of lighting circuits. Lighting control shall be implemented using electro-mechanical relays controlled through PLC output modules.

E. Upon loss of power to the auxiliary system or failure of the PLC input and output modules, the system shall change state to the safest condition for the facility staff.

1. Lighting relays shall fail closed to allow lighting to be on, if the lighting circuit is powered.

F. Configure the system to automatically turn on lights, which are controlled, in an area from which a duress alarm has been received.

G. Configure the system to automatically turn on all controlled lights when an emergency evacuation has been initiated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Auxiliary Control Relays

1. Provide relays to switch the auxiliary circuits as scheduled. Provide one relay per scheduled device.
2. Manufacturers
   a. Omron G2R DPDT series relays with din rail terminal base
   b. Finder
   c. Idec
   d. Phoenix
   e. Approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all areas are ready to receive work.

B. Verify required utilities are available, in proper location and ready for use.

3.2 INSTALLATION

A. Field testing and inspection shall be performed.

B. Replace equipment, components and wiring as required to achieve a fully functional system.

3.3 ADJUSTING AND CLEANING

A. When requested by Architect or Owner within one year of Substantial Completion, provide on-site assistance in adjusting levels and adjusting controls to suit actual occupied conditions.

3.4 UTILITY SCHEDULE

A. Lighting Control Schedule: Refer to electrical relay panel schedules for lighting relay requirements.
   1. Include 5 spare output points for additional lighting control.

B. Water Control Schedule: Provide water control at plumbing fixtures in Holding areas. Refer to isolation valve schedule/detail for requirements.
   1. Include 5 spare output points for additional water control.

END OF SECTION 285500

SECTION 285900 - SECURITY MANAGEMENT SERVER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this section.

1.2 SYSTEM DESCRIPTION

A. The SMS data recording engine shall log security commands made within the detention facility as they happen. The SMS shall provide facility administrators the ability to monitor and review all operational aspects of the Security Control System and its operations. The intent is that by recording all actions of the system, it shall provide owner with greater liability protection and system accountability.

B. Software Requirements

1. The Security Management Server (SMS) shall have the following software requirements to allow for seamless Control and future flexibility.
   a. Data Logging
      1) The SCSC shall provide a SMS system with a single point for logging, recording, report generation and backup. Distributed databases are not acceptable.
      2) The SMS shall be capable of processing 500,000 transactions per day (minimum).
      3) The SMS shall be capable of communication to multiple PLCs over Ethernet.
   b. Archiving & System Management
      1) The database shall be able to contain up to 5 million transactions prior to the need to archive data.
      2) Automatic archives shall be user configurable for frequencies of daily, weekly, monthly, quarterly, semi-annual, or yearly. In addition, the user shall be able to select the day of the week or month to create the archives.
      3) When performing an archive, the user shall be able to select to archive only, archive and delete the archived events from the database, or delete only. .
      4) Archived events shall be viewable in an identical format as the original SMS, using the standard SMS application. The sorting, searching, and reporting generating functionality shall be identical to the standard SMS application as well.
      5) The system shall notify the user when the transaction register reaches a user definable limit to allow for data archiving. If the database reaches the user defined limit, an automatic archive will be performed so that current logging will not be affected.
      6) The user shall have the ability to set an expiration date for all archives stored on the SMS computer. Archives that have reached their expiration dates shall be deleted automatically to create additional hard drive space.
      7) The system shall notify the user when the hard drive reaches a user definable percentage of free hard drive space. If the hard drive reaches the user defined limit, the archives shall be deleted automatically so that current logging will not be affected.

8) The user shall have the ability to perform a full database backup.

C. System Features

1. The Security Management Server (SMS) performs several valuable functions, but is not an essential component of any operational control system. It shall be configured as follows:
   a. The SMS shall be connected via Ethernet to the PLC controller.
   b. The SMS shall receive and record alarms and transactions from the PLC within 500 milliseconds of the occurrence. The SMS shall record Time/Date, Device Type, Device Name, Event Name/Description, and the name of the VGUI and operator for VGUI initiated actions.
   c. Transactions & Alarms shall include, but are not limited to:
      1) The SMS shall record to disk all door activities, including unlock requests, unlocking, re-locking, secure actions, door position changes, lock status, alarms, alarm silencing, and alarm resetting.
      2) Changing the state of ISOLATED doors is recorded to disk by the SMS.
      3) All interlock override activities.
      4) The SMS records all intercom call activity, including when the call was placed or audio threshold alarm occurred, when the station was connected to, and when the call was disconnected.
      5) Every intercom pushbutton press.
      6) All communications ISOLATE activities.
      7) All Access control system activities.
      8) All pushbutton and request to exit activities.
      9) All Duress system activities.
      10) All video system activities.
      11) All Utility control activities.
      12) All PLC system faults.
      13) All VGUI login/logout activities.
   d. All transactions (action codes), alarms and status are continually outputted from the PLC. The PLC shall be able to service this data management activity and continually control all other devices specified elsewhere in this specification without any additional delay in system throughput.
   e. The SMS will provide preventative maintenance and enhanced analysis functions.
2. The SMS provides the following features:
   a. If multiple VGUI stations and/or Graphic control panels and/or PLCs are provided, the SMS shall be capable of recording all events of all stations, panels and PLCs.
   b. Transactions sent to screen, disk or printer are time and date stamped.
   c. Provide password protection to prevent modifications to the database system.
   d. All reports/searches shall take less than 60 seconds to generate for the most intensive retrieval.
   e. The database reports shall include the option to export the data to a comma-separated file (CSV) or an XML file to be used by owner provided software.
3. The SMS will include a complete comprehensive relational database report utility. All reports are titled and time and data stamped. It shall be possible to easily select reports to show the history of any device or group of devices between specified times and dates.

4. The user shall have the ability to easily display all of the events or to filter the events based on the device type (ex: doors or cameras) or based on a specific device (ex: 'Front Door').
5. The user shall be able to quickly display events for pre-defined time periods such as previous hour, previous 24 hours, previous 7 days, etc.
6. The user shall have the ability to perform an advanced search which allows the operator to select any and all transaction types, alarms, watchtour, time changes and any other system functions as described in the specifications, and is done by defining a start date and time and a stop date and time. The computer will search any applicable matching occurrences and print either to the screen or printer as a report; thus allowing searching for:
   a. Specific date/time ranges
   b. Specific device types
   c. Specific device names
   d. Specific keyword
   e. Any combination of the above

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Computer Hardware configuration

1. The server shall have the following minimum requirements:
   a. Processor: Intel Xeon E5-2609v3, 1.9GHz, 15MB Cache, 6 Cores
   b. Operating System: Window Server 2016
   c. Internal Memory: 32GB, DDR4, 2133 MHz
   d. Storage: 3-500GB 6G SAS Hard Drives (1.5TB total)
   e. Storage Type: RAID 5
   f. Network: 4-Gigabit Ethernet Ports
   g. Power Supply: Dual, Hot Swappable
2. The server shall have a licensed copy of the HMI software installed.
3. The server shall be administered remotely using any control station on the security network.
4. Approved Manufacturers:
   a. HP
   b. Dell
5. Server shall connect to KVM being used for the Video Management System.

END OF SECTION 285900

SECTION 31 20 00 – EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 01 21 00 and the Bid Form for information concerning required allowances and unit prices.

C. Refer to Section 31 10 00 for topsoil stripping and Sections 32 92 00 and 32 93 00 for topsoil placement.

1.2 SUMMARY

A. This Section includes the following:

1. Excavation, filling, backfilling, and grading indicated and necessary for proper completion of the work.
2. Preparing of subgrade for building slabs, walks, and pavements.
3. Drainage/porous fill course for support of building slabs.
4. Excavating and backfilling of trenches.
5. Excavating and backfilling for underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.

1.3 SUBMITTALS

A. VDOT approved Job Mix for stone.

B. Imported fill (if required): Submit location of borrow pit and a sample of the soil for approval to the Owner's Geotechnical Engineer a minimum of fourteen (14) working days prior to use.

C. Geotextile Fabric

1.4 DEFINITIONS

A. Excavation: Removal of all material (except for rock) encountered to design subgrade elevations indicated for cut areas and to subsoil elevations in fill areas. Excavation also includes subsequent respreading, moisture conditioning, compaction, and grading of satisfactory materials removed.

B. Unauthorized Excavation: Removal of materials beyond the limits indicated in the definition of "Excavation" without specific direction of Engineer.

C. Additional Excavation: Removal, disposal and replacement of materials beyond the limits indicated in the definition of "Excavation" at the direction of the Engineer. Refer to Part 3 of this Section for requirements of Additional Excavation.

D. Subgrade: The undisturbed earth (in cut) or the compacted soil layer (in fill) immediately below granular subbase, drainage fill, or topsoil materials.

E. Subsoil: The undisturbed earth immediately below the existing topsoil layer.

F. Building Pad: The area extending 10 feet beyond the exterior limits of the building/column footings and down to undisturbed soils at a one horizontal to one vertical slope.

G. Structures: The area extending a minimum of ten (10) feet beyond the edge of foundations, slabs, curbs, underground tanks, piping or other man-made stationary features occurring above or below ground surface.

H. Pavements: The area extending 10 feet beyond the exterior limits of paved areas and down to undisturbed soils at a one horizontal to one vertical slope. The area extending 3 feet beyond the exterior limits of walks and down to undisturbed soils at a one horizontal to one vertical slope.

I. Subbase Material: Artificially graded mixture of crushed gravel or crushed stone meeting VDOT specifications. Material type is indicated on the drawings.

J. Drainage/Porous Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel meeting the requirements of VDOT No. 57 Stone.

K. Rock: Hard bed rock, boulders or similar material requiring the use of rock drills for removal. The criteria for classification of general excavation as rock is any material which cannot be dislodged by a Caterpillar D-8 Tractor, or equivalent, equipped with a single tooth hydraulically operated power ripper. The criteria for trench rock shall be that a Caterpillar 345 Backhoe, or equivalent, with a proper width bucket cannot remove the material.

1.5 ADDITIONAL WORK

A. Paragraph 4.3.4 of General Conditions refers to certain conditions that may require additional excavation work. This paragraph is further defined herein and, where there are conflicts, is superseded by this section.

B. Claims for concealed, unknown, or unanticipated subsurface conditions are limited to those circumstances where:

1. Additional excavation work is required below the contract limits indicated to provide acceptable bearing for building pad, structures or pavements.
2. Additional excavation work is required to raise, lower, or revise the footings, foundations or other parts of the building to provide acceptable bearing.
3. Additional excavation work below the utility trench design elevations, for utilities outside the limits of the building, as required to provide acceptable bearing for the utility.
4. Rock is encountered between existing grade and design subgrade.

C. The risks of concealed, unknown, or unanticipated subsurface conditions (except for rock) from existing ground surface to the design subgrade elevations in cut areas and to subsoil elevations in fill areas shall be included in the Contract Amount and shall not be considered as grounds for additional costs to the Contract. The risks of concealed, unknown, or unanticipated subsurface conditions below the elevations stated above shall be considered as Additional Excavation.

D. During construction, if concealed, unknown, or unanticipated subsurface conditions are encountered which require that footings, foundations or other parts of the building be raised, lowered or revised to provide acceptable bearing for the building or if, outside the building limits, additional depth of utility trench excavation below the design subgrade or subsoil elevations is required, immediately notify the Engineer upon discovery of such condition prior to disturbing the material encountered.

E. Payment for additional work

1. Additional excavation shall be counted toward the unit price allowances established in the Bid Form. The Owner reserves the right to negotiate said unit price allowance prior to the Award of Contract.
2. Lowering of footings and trenches shall be counted toward the unit price allowances established in the bid form.
3. Rock removal, if required, shall be paid for at a negotiated amount. Rock payment lines are limited to the following:

    a. Two feet outside of concrete work for which forms are required, except footings.
    b. One foot outside perimeter of footings, two feet below bottom of footings.
    c. In pipe trenches, 6 inches below invert elevation of pipe and 2 feet wider than outside diameter of pipe, but not less than 3 feet minimum trench width.
    d. Outside dimensions of concrete work where no forms are required.
    e. Under slabs on grade, 6 inches below bottom of concrete slab.

4. No payment will be made for unauthorized excavation.

1.6 EARTHWORK BALANCE ADJUSTMENTS

A. Adjustments of grades may be allowed with prior written approval of the Engineer in order to accommodate shortfall or surplus of material that may occur. Should adjustments be allowed, maintenance of designed drainage patterns and required adjustments to drainage structures shall be Contract responsibility. No additional payment will be made for these adjustments.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Environmental Compliance:

1. Comply with the requirements of the latest edition of the Virginia Erosion and Sediment Control Handbook for erosion control during earthwork operations.

C. Testing and Inspection Service: Owner will employ and pay for an independent Geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations. Cooperate with Owner's Geotechnical Engineer as required for testing and inspection of work. These services do not relieve the responsibility for compliance with Contract Document requirements.

D. The Owners testing agency will test crushed recycled concrete for use as pavement base course.

1.8 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt existing utilities serving offsite property owners except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify engineer not less than 48 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without receiving engineer's written permission.
3. Existing utilities across or along the line of work are indicated only in an approximate location. Locate all underground lines and structures. Call "Miss Utility" at 1.800.552.7001 prior to construction. If utilities are marked that are not shown on the plans, locate utility vertically and horizontally and provide information to architect. Repair and correct any damage to underground lines and structures.

1.9 SAFETY

A. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction and governing regulations and standards.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Work within the road right-of-way shall meet all requirements of the latest edition of the Virginia Department of Transportation Work Area Protection Manual.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups SM, SW, SP, GP, CL, ML, SC, GC, GM and GW with dimensions not to exceed 2 inches in diameter. All material used for structural fill shall be evaluated by the owner's geotechnical engineer to determine if it is suitable for the intended purpose.

B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups OL, OH, PT, GT, CH, MH.

C. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension (2 inches for material used in trench backfill), debris, waste, frozen materials, vegetation and other deleterious matter.

D. Imported material for structural fill shall comply with ASTM D2487 soil classification groups SM, SP, SW, GP, or GW with dimensions not to exceed 2 inches in diameter. Offsite borrow material shall have a plasticity index less than 20.

2.2 ACCESSORIES

A. Non-woven Geotextile Fabric (for drainage): Mirafi 140N, or equivalent.

B. Woven Geotextile Fabric (for reinforcement): Mirafi 600X, or equivalent.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in "Erosion Control" during earthwork operations.

D. The Contractor will limit traffic on stripped or undercut subgrades. The Contractor will utilize light weight, track-mounted dozer equipment for stripping.

3.2 DEWATERING

A. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or runoff areas. Do not use utility trench excavations as temporary drainage ditches.

B. Should any springs or running water be encountered in the excavation, notify the Architect and provide discharge by trenches (or other acceptable means) and drain to an appropriate point of disposal.

C. Provide temporary drainage facilities to minimize the flow of rainwater onto adjacent property. Repair any damage to property or to subgrade as a result of construction and/or dewatering (or lack thereof) operations at no additional cost to the Contract. If permanent provision must be made for disposal of water other than as indicated, the Contract price shall be adjusted.

D. Soils encountered may require discing, scarifying, moisture conditioning, harrowing, pulverizing, or other special or careful handling when utilized as fill. No additional payment will be made for these operations.

3.3 EXCAVATION

A. Excavation consists of removal, placement and disposal of material encountered when establishing required subgrade or finish grade elevations.

1. Excavation includes removal and disposal of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

B. Rock Excavation: If Rock is encountered the Owner's Geotechnical Engineer will verify that the material qualifies for classification as rock excavation.

1. If rock is encountered in grading, remove to depths as follows:

   a. Under surfaced areas, to 6" under the respective subgrade for such areas.
   b. Under grass and planted areas – 12" minimum.
   c. Under footings – Two feet below bottom of footing, One foot outside of perimeter of footing.

2. A surveyor licensed in the Commonwealth of Virginia and employed by the Contractor shall calculate the quantity of material removed as Rock Excavation. The quantity of rock calculated shall not exceed the volume determined by the payment limits. The Owner's Project Representative shall review the quantity calculated within 48 hours of receiving the survey notes. The cost of quantifying the material shall be included in the unit price allowance(s) for Rock Excavation (Mass and Trench).

3.4 EXCAVATION FOR BUILDING PAD AND STRUCTURES

A. Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for review.

B. Excavations for footings and foundations: Do not disturb bottoms of excavation. Excavate by hand to elevations required just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

1. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of footing.

C. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus, a sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction and for review. Do not disturb bottom of excavations intended for bearing surface.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.

B. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

1. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.
2. For pipes or conduit less than 6 inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
3. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom ¼ of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads ensure continuous bearing of pipe barrel on bearing surface.

3.7 EXCAVATION STABILITY

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing as excavation progresses.

3.8 SUBGRADE INSPECTION

A. Notify Engineer when mass, trench and footing excavations have reached required subgrade. The Architect will arrange for an inspection of conditions by the Owner's Geotechnical Engineer. Alternative procedures for arranging this review may be implemented at the Owner's written option.

B. If the Owner's Geotechnical Engineer determines that the subgrade bearing conditions are unacceptable, the Engineer will authorize additional excavation until suitable bearing conditions are encountered.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump trunk weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

D. Under supervision of the Owner's Geotechnical Engineer, proofroll subgrade in cut areas below the building pad and pavement(s) with a loaded dump truck or other approved pneumatic tired vehicle. Should any unstable sub-soil be encountered below pavement or structures, break up the top eight inches of ground surface, pulverize, moisture-condition to optimum moisture content, and compact to percentage of maximum density as stated in Percentage of Maximum Density Requirements. Perform this work at no additional cost and/or time to the Contract.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 ADDITIONAL EXCAVATION

A. Additional Excavation (Mass): Remove excavated materials and dispose of on-site as directed by the Engineer. Replace this excavated material with satisfactory material placed and compacted according to the requirements of the "Placement and Compensation" section.

B. Additional Excavation in Trenches: Remove excavated materials and dispose of on-site as directed by the engineer. Replace this excavated material with stone.

C. Additional Excavation in Footings: Remove excavated materials and dispose of on-site as directed by the Engineer. Replace this excavated material with lean concrete/flowable fill or with stone extending 12 inches laterally beyond the footing in all directions.

D. The quantity of material removed as Additional Excavation (Mass, Trench or Footing) shall be calculated by a surveyor licensed in the Commonwealth of Virginia and employed by the Contractor. The Owner's Project Representative shall review the quantity calculated within 48 hours of receiving the survey notes. The cost of quantifying the material shall be included in the unit price allowance(s) for the type of Additional Excavation.

E. Protect the subgrade during construction:

1. During wet conditions, the subgrade soils may become saturated and soften, possibly resulting in damage to the subgrade if disturbed by equipment. Correct subgrade damaged in this manner. No additional payment will be made to correct subgrade damaged in this manner.
2. During construction limit traffic on approved subgrade. Construction traffic on the approved subgrade may damage the approved subgrade. Correct subgrade damaged in this manner. No additional payment will be made to correct subgrade damaged in the manner.

3.10 UNAUTHORIZED EXCAVATION

A. Correct Unauthorized Excavation as follows:

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to Engineer.
2. Elsewhere, backfill and compact unauthorized excavations as indicated for authorized excavations of same classification unless otherwise directed by the Engineer.

3.11 STORAGE OF EXCAVATED MATERIALS

A. Temporarily stockpile excavated materials acceptable for use as backfill and fill. Place, grade, and shape stockpiles for proper drainage. Cover to prevent windblown dust.

1. Stockpile excavated materials away from edge of excavations. Do not store within the drip line of trees to remain.

3.12 BACKFILL AND FILL

A. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance by local authority having jurisdiction of construction below finished grade, including perimeter insulation.
2. Review, approval, and recording of the locations of underground utilities.
3. Removal of concrete formwork.
4. Removal of shoring and bracing (including backfilling of voids with satisfactory materials).
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow or ice.

C. Ground Surface Preparation: Remove vegetation, debris, obstructions, and deleterious materials from ground surface prior to placement of fills.

D. Bench slopes surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material. Plow, scarify, bench or break up slopes surfaces flatter than 1 vertical to 4 horizontal so fill material will bond with existing material.

E. Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials indicated in Part 2 of this Section.

1. Under grassed areas, use satisfactory excavated or borrow material.
2. Under walks, curbs, and pavements, use satisfactory excavated or borrow material.
3. Under building slabs, use satisfactory excavated or borrow materials and drainage/porous fill material as indicated.

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. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

D. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.

G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

K. Do not backfill trenches until any required testing and inspections have been completed and Engineer authorizes backfilling. Backfill carefully to avoid damage or displacement of pipe systems.

L. Under piping and conduit and equipment, use crushed stone where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.

M. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement or piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 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 3 percent and is too wet to compact to specified dry unit weight.

B. 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. Maintain the moisture content of the structural fill materials to within 3% of the optimum moisture content until permanently covered.

C. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to required density.

1. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.
2. Work wet materials as directed by the Owner's Geotechnical Engineer. Base bids on working material daily for a maximum of five days of acceptable weather.
3. No additional payment will be made for these operations.

3.15 COMPACTION OF SOIL BACKFILL AND FILLS

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. 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.

C. Control soil and fill compaction, providing minimum percentage of density indicated for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.

D. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density at a moisture content within 3% of optimum in accordance with ASTM D698:

1. Under structures, building pad and pavements, compact each layer of backfill or fill material at 95 percent maximum density. This includes ground under future expansion areas.
2. Under grass or unpaved areas, compact each layer of backfill or fill material at 90 percent maximum density.

E. Seal all fill areas at the end of each working day, utilizing a smooth drum roller.

3.16 GRADING

A. General: Rough grading of areas within the Project, including cut and fill section and adjacent transition areas, shall be reasonable smooth, compacted and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or motor patrol except as otherwise indicated. The finished subgrade surface from the grassed areas generally shall be not more than 0.2 feet above or below the final grade or approved cross section, with due allowance for topsoil.

B. The tolerance for areas within 10 feet of building perimeter, walks and all areas to be paved shall not exceed 0.10 feet above or below the established subgrade. Finish all ditches, swales and gutters to drain readily. Unless otherwise indicated, evenly slope the subgrade to provide drainage away from building walls in all directions at a grade not less than ¼ inch per foot. Provide rounding at top and bottom of cut and fill slopes and at other breaks in grade.

C. Protection of Graded Areas: Protect newly graded areas and areas of cut, fill and design/subgrade elevations from the actions of the elements and from deterioration as a result of construction operations and weather conditions (frost, rains, snow, sleet, hail, etc.). Repair any settlement or washing that occurs prior to or after acceptance of the work. Fill to required subgrade levels any areas where settlement occurs. Protect trees to remain, and, at all areas of the Site where construction operations are in progress, provide protection for the safety of occupants of the existing facilities.

D. 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.

E. Site Grading: Slopes grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus ½ inch.
3. Pavements: Plus or minus ½ inch.

F. Grading inside Building Lines: Finish subgrade to a tolerance of ½ inch when tested with a 10-foot straightedge.

3.17 PAVEMENT SUBBASE COURSE:

A. General: Place subbase material, in layers of indicated thickness, over subgrade surface to support a pavement base course.

B. Grade Control: During construction, maintain lines and grades including crown and cross slope of subbase course.

C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least at 12" width of shoulder simultaneously with compacting and rolling each layer of subbase course.

D. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

E. When a compacted subbase course is 6" thick or less, place material in a single layer. When more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

F. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

G. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase and base course to required crown elevations and cross-slope grades.
4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698.

H. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construction shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.18 BUILDING SLAB DRAINAGE COURSE

A. General: Place drainage/porous fill material, over subgrade surface to support concrete building slabs and sidewalks areas indicated.

B. Place drainage course on subgrades free of mud, frost, snow, or ice.

C. Placing: Place drainage/porous fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

D. When a compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

3.19 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

1. If in the opinion of the engineer, based on testing service reports and inspection, subgrade or fills have been placed that are below required density, perform additional compaction and testing until required density is obtained.

B. The Owner will engage, and pay for, the services of a Geotechnical Engineer whose function shall be to afford complete engineering control by testing of the conditions of all footing subgrades, the placement of all structural fills under structures, building pad and pavement areas, and all compaction where required, and to observe the proof rolling of the building pad and pavement areas.

C. The Owner's Geotechnical Engineer will be present as deemed necessary during all phases of the Work requiring filling, compaction operations or testing. The Geotechnical Engineer will provide the engineer with written certification that fill, and compaction was competed with accepted materials in accordance with the Documents and give a professional opinion regarding shrinkage or settlement of fill and safe load bearing capacity of fill.

D. Site Preparation and Proofrolling: The Owner's Geotechnical Engineer will determine if any additional excavation or in-place densification is necessary to prepare a subgrade for fill placement for slab or pavement support.

E. Fill Placement and Compaction: The Owner's Geotechnical Engineer will witness all fill operations and take sufficient in-place density tests to verify that the indicated degree of fill compaction is achieved. The Owner's Geotechnical Engineer will observe and approve borrow materials used and shall determine if their existing moisture contents are suitable/acceptable.

F. Footing Excavation Review: The Owner's Geotechnical Engineer will review the footing excavations for the building foundations. He will verify that the design bearing pressures are available and that no loose or soft areas exist beneath the bearing surfaces of the footing excavations.

G. The Owner's Geotechnical Engineer will submit two (2) copies of each of his reports, recommendations and/or opinions to the Engineer and the Owner. Pertinent information will be provided to the Contractor as required.

3.20 EROSION CONTROL:

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction, the Virginia Erosion and Sediment Control Handbook, and as indicated in the Contract Documents.

3.21 PROTECTION

A. Repair and reestablish grades in settled, eroded, and rutted areas to indicated tolerances.

B. Reconditioning Compacted Areas: Where subsequent construction operations or adverse weather disturbs completed compacted areas, scarify surface, reshape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

D. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.22 DISPOSAL OF WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including trash and debris, and dispose of it off Owner's property in a legal manner.

B. Dispose of materials not acceptable for use as backfill or fill legally offsite.

C. Do not remove topsoil from site until it has been demonstrated to the Owner's satisfaction that it is excess.

D. Disposal of waste materials will be at the Contractor's expense and will not be grounds for requesting additional compensation.

END OF SECTION

SECTION 32 12 16 – ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes following:

1. Hot-mix asphalt paving over prepared subbase.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt overlays.

1.3 SUBMITTALS

A. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

C. Traffic maintenance and Work Area Protection Plan: Submit a plan indicating sequencing and measures to be used for the maintenance and protection of traffic during operations within or immediately adjacent to existing roadways open to vehicular traffic. The engineer and the City of Staunton must approve this plan prior to commencement of work within the Right-of-Way.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Asphalt paving materials and installation shall conform to the requirements of the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specification and Road and Bridge Standards.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum ambient temperature of 50 deg F (10 deg C), and when temperature has not been below 35 deg F (1 deg C) for 12 hours immediately prior to application.
2. Asphalt Base Course: Minimum surface temperature of 40 deg (4 deg C) and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.

1.6 TESTING AND INSPECTION

A. Within the road Right-of-Way, city inspectors shall observe the asphalt placement. Coordinate the necessary inspection schedule with the the City of Staunton.

B. The Owner's testing agency will observe the asphalt placement in on-site areas not in Right-of-Way.

PART 2 - PRODUCTS

2.1 ASPHALT-AGGREGATE MIXTURE

A. General: Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with the requirements of the VDOT Road and Bridge Specifications and as recommended by local paving authorities to suit project conditions.

2.2 ASPHALT MATERIALS

A. Tack Coat: ASTM D977, emulsified asphalt or ASTM D2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

B. Prime Coat: Asphalt emulsion prime conforming to VDOT requirements.

2.3 AUXILIARY MATERIALS

A. Paving Geotextile: Nonwoven polypropylene, specifically designed for paving applications, resistant to chemical attack, rot, and mildew.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify engineer in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 MAINTENANCE AND PROTECTION OF TRAFFIC

A. Utilize flagmen, barricades, warning signs and warning lights as required by the Virginia Work Area Protection Manual.

3.3 PATCHING AND REPAIRS

A. Patching: Saw cut perimeter of patch and excavate pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.

1. Tack coat faces of excavation and allow to cure before paving.
2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

B. Leveling Course: Install and compact leveling course consisting of dense-graded, hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

C. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of ¼ inch (6 mm). Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that accumulated near cracks or joints.

D. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or Portland Cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. of surface.

1. Allow tack coat to cure undisturbed before paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surrounds. Remove spillage and clean affected surfaces.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

C. Prime Coat: For asphalt sections less than 4" thick, apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

3.5 GEOTEXTILE INSTALLATION

A. Apply bond coat, consisting of asphalt cement, uniformly to existing surfaces at a rate of 0.20 to 0.30 gal./sq. yd. (0.8 to 1.2 L/sq. m).

B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).

1. Protect paving geotextile from traffic and other damage and place overlay paving the same day.

3.6 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

1. Place hot-mix asphalt base course in number of lifts and thickness indicated.
2. Spread mix at minimum temperature of 225 def F (107 deg C).

B. Place paving in consecutive strips not less than 10 feet (3 m) wide, except where infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing intermediate or surface courses.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

A. Construct joints between old and new pavement, or between successive days work, to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat.
2. Offset longitudinal joints in successive courses a minimum of 6 inches (150 mm).
3. Offset transverse joints in successive courses a minimum of 24 inches (600 mm).

4. Construct transverse joints as required by the VDOT Road and Bridge Specifications.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

3.8 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve indicated density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 95 percent of reference laboratory density according to ASTM D1559.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm. Surface course average density shall be 95 percent of reference laboratory density.

E. Edge Shaping: While surface is being compacted and finished, trip edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method. Edges adjacent to curbs and curb and gutter sections shall be flush with the edge of concrete.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus ½ inch (13 mm).
2. Surface Course: Plus ¼ inch (6 mm), no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: ¼ inch (6 mm).
2. Surface Course: 3/16 inch (3 mm).
3. Crowned Surface: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is ¼ inch (6 mm).

C. Check surface areas at intervals as directed by Engineer.

3.10 FIELD QUALITY CONTROL

A. Within the VDOT Right-of-Way coordinate required inspections with the Virginia Department of Transportation.

B. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and stating each report whether tested Work complies with or deviates from requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

D. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with requirements.

END OF SECTION

SECTION 32 13 13 – SITE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplemental Conditions and other Division 1 Specification Sections, apply to this section.

1.2 DESCRIPTION OF WORK:

A. Extent of Portland cement concrete paving is shown on drawings, including:

1. Curbs and gutters
2. Walkways
3. Service area pavement.

1.3 SUBMITTALS

A. Provide certification that all materials meet VDOT standards for the class of concrete required.

1.4 JOB CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

1. Use flexible spring steel forms or laminated boards to form radius bends as required.
2. Coat forms with a nonstaining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.

C. Reinforcing Steel: ASTM A 615, Grade 60, deformed

D. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

E. Expansion Joint Materials: Comply with requirements of applicable Division 7 sections for preformed expansion joint fillers and sealers.

F. Antispalling Compound: Combination of boiled linseed oil and mineral spirits, complying with AASHTO M-233.

G. Liquid-Membrane Forming and Sealing Curing Compound: Comply with VDOT Road and Bridge Specifications.

2.2 CONCRETE MIX, DESIGN, AND TESTING

A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control or VDOT Road and Bridge Specifications whichever is more stringent.

B. Design mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:

1. Comply with the requirements of VDOT Std. Class A3 Concrete, unless otherwise indicated.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving,

3.2 FORM CONSTRUCTION

A. Set forms to required grades and lines, braced and secured. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8 inch in 10 feet.
2. Vertical face on longitudinal axis, not more than 1/4 inches in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 REINFORCEMENT

A. Locate, place and support reinforcement as specified in Division 3 sections, unless otherwise indicated.

3.4 CONCRETE PLACEMENT

A. General: Comply with requirements of applicable Division 3 sections for mixing and placing concrete or VDOT Road and Bridge Specifications whichever is more stringent.

B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

D. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

E. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

F. Place concrete in 2 operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

G. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

H. Curbs and Gutters: Automatic machine may be used for curb and gutter placement. If machine placement is to be used, submit revised mix design and laboratory test results that meet or exceed minimums indicated. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as indicated for formed concrete. If results are not acceptable, remove and replace with formed concrete meeting requirements.

3.5 JOINTS

A. General: Construct expansion, weakened-plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.
2. Sawed Joints: Form weakened-plane joints with powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
3. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.

C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than 1/2 hour, except where such placements terminate at expansion joints.

D. Construct joints as indicated or, if not indicated, use standard metal keyway-section forms.

E. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.

F. Locate expansion joints at 30 feet o.c. for each pavement lane unless otherwise indicated.

G. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

H. Provide joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

I. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

J. Fillers and Sealants: Comply with requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

3.6 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10-ft. straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:

1. Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.
2. Exposed-Aggregate Finish: At handicap ramps and where indicated on drawings, by applying an approved retardant curing compound to the surface. Allow minimum 12 hours of setting time before washing surface to expose a maximum of (1/3) one-third of stone surface. Aggregate shall be brown Riverstone having a uniform size and color for each subsequent concrete pour. Aggregate size shall range between 1/2" and 3/4".

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

3.7 CURING

A. Protect and cure finished concrete paving in compliance with applicable requirements of Division 3 sections. Use membrane-forming curing and sealing compound or approved moist-curing methods.

3.8 REPAIRS AND PROTECTIONS

A. Repair or replace cracked, broken or defective concrete curbs and curb and gutter, as directed by engineer.

B. Replace cracked, broken or defective concrete sidewalks.

C. Repair or replace cracked, broken or defective concrete pavement, as directed by engineer.

D. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

E. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

F. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.

END OF SECTION

SECTION 32 17 00 - PAVEMENT MARKINGS, SIGNS, AND SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Establishing the location of pavement markings and applying pavement markings for parking space lines, traffic control, fire lane and accessible spaces.

2. Installation of signs for traffic control and accessible spaces.

3. Installation of wheel stops at parking spaces.

1.3 QUALITY ASSURANCE

A. All work and materials shall conform to the requirements of the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications and Road and Bridge Standards.

B. All materials for signs shall conform to the requirements of the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications and Road and Bridge Standards and to the requirements of the latest edition of the Manual of Uniform Traffic Control Devices for traffic signs.

C. Installer Qualifications: Engage an experienced installer, who has successfully completed striping and signage projects similar in size and complexity to this project. The installer's primary business (defined as a minimum of 60% of total billings) shall be striping and signage.

1.4 SUBMITTALS

A. Product Data and written confirmation that the following materials are included on VDOT's list of approved construction materials:

1. Pavement marking paint
2. Wheel stops
3. Signs
4. Posts

PART 2 - PRODUCTS

2.1 PAVEMENT MARKING PAINT

A. Paint shall be Type A, water emulsion base, traffic paint conforming to the requirements of Section 704 of the VDOT Road and Bridge Specifications and Federal Specification TT-P-1952. Color shall be white unless otherwise indicated.

B. Curb painting color along fire lanes shall be yellow, unless otherwise indicated.

C. Type B thermoplastic lane markings are required within VDOT rights-of-way.

2.2 PAINT APPLICATOR

A. Provide hand-operated push-type applicator machine of a type commonly used for application of paint to pavement surfaces. Paint applicator machine shall be acceptable for marking small street and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles and shall be capable of applying paint uniformly at coverage specified.

2.3 WHEEL STOPS

A. Wheel stops shall be made of 3,000 psi precast concrete and be 6 inches high, 8 inches wide and approximately 6 feet long. Provide chamfered corners and edges and two holes for anchoring.

2.4 SIGNS AND POSTS

A. Signs shall conform to the requirements of Section 701 of the VDOT Road and Bridge Specifications. Signs shall be fabricated with encapsulated lens sheeting.

B. Signposts for traffic control signage shall be 4" x 4" treated wood conforming to the requirements of Section 236 of the VDOT Road and Bridge Specifications.

C. Utilize metal posts for fire-lane signage and for signage at accessible parking spaces.

2.5 CONCRETE

A. Concrete shall be Class A3, General concrete, conforming to the requirements of Section 217 of the VDOT Road and Bridge Specifications.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION FOR PAVEMENT MARKING

A. Apply pavement markings only when the ambient temperatures is above 50°F and less than 95°F, unless otherwise approved.

B. Allow pavement to cure for a period of not less than 7 days before applying pavement marking.

C. Clean surfaces thoroughly 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 as required.

D. Remove existing pavement markings, residual curing compounds and other coating adhering to the pavement with scrapers, wire brushes, waterblasting, sandblasting or mechanical abrasion as required. Areas of existing pavement affected by oil or grease shall be scrubbed with an approved chemical and rinsed thoroughly. Seal oil-soaked areas with shellac or primer after cleaning.

E. Pavement surfaces shall be dry and clean prior to painting. Pavement markings shall not be applied within 24 hours following rain or other inclement weather or when rain is imminent.

F. Apply seal coat across the existing pavement to provide a uniform surface appearance.

3.2 APPLICATION OF PAVEMENT MARKING

A. Apply paint in accordance with the requirements of Section 704 of the VDOT Road and Bridge Specifications.

B. Lay out lines and markings to the width and length as indicated. All parking space lines shall be 4 inches wide.

C. Apply paint with an approved paint applicator.

D. Apply paint at manufacturer recommended rates to provide a minimum 15 mil wet thickness (depending on manufacturer, may require 2 applications).

3.3 FIRE LANE MARKINGS AND SIGNAGE

A. Mark fire lanes and install fire lane signage in accordance with the requirements of the local Fire Marshall.

3.4 INSTALLATION OF WHEEL STOPS

A. Secure wheel stops with two 1/2-inch diameter steel reinforcing rods. Rods shall be a minimum of 18 inches in length and be embedded into the pavement, base and subgrade a minimum of 12 inches and be flush with the top of the bumper block.

3.5 INSTALLATION OF SIGNS

A. Install signs on signposts in accordance with the requirements of Section 701 of the VDOT Road and Bridge Specifications.

B. Install signposts in concrete foundation to a depth of 3 feet minimum by 12 inches in diameter.

END OF SECTION 32 1700

SECTION 323114
SECURITY CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 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.

B. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.

C. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric.

D. ASTM F900 - Standard Specification for Industrial and Commercial Steel Swing Gates.

E. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.

F. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction.

G. CLFMI CLF-PM0610 - Product Manual.

H. CLFMI CLF-SFR0111 - Security Fencing Recommendations.

I. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric).

J. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

K. NFPA 70 - National Electrical Code.

L. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

M. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

N. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting at the Project Site one week before starting work of this section; require attendance by affected installers.

1.03 SUBMITTALS

A. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.

B. Design Calculations: Provide calculations for fence fabric and accessory selection as well as line post spacing and foundation details. Refer to CLFMI WLG 2445 for line post and spacing and ASTM F1043 for framing strength tests.

C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. Refer to CLFMI CLF-SFR0111 for planning and design recommendations.

D. Fence Installer Qualification Statement.

1.04 QUALITY ASSURANCE

A. Fence Installer: Company with demonstrated successful experience installing similar projects and products, with documented experience on security / detention type applications.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

1. Warranty shall cover deterioration of fence and gate materials and finishes.
2. Warranty shall cover all electrical operating components including gate operator, motor, and controls.

PART 2 PRODUCTS

2.01 SECURITY FENCE

A. Security Fence, General:
   1. Size posts, rails, and frame components to comply with ASTM F1043 for height indicated.
   2. Fence Height: 12 feet, unless otherwise indicated.

B. Posts, Rails, and Frames:
   1. Form from hot-dipped galvanized steel formed to round pipe, ASTM A653/A653M, HSLAS, Grade 50 (yield strength 50,000 psi), with G90 (Z275) zinc coating.
   2. Line Posts: Type I round steel pipe in accordance with FS RR-F-191/1D.
   3. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round steel pipe in accordance with FS RR-F-191/1D.
      a. Posts for swing gates shall comply with ASTM F900.
   4. Security Strap: Provide 12 gauge galvanized steel security straps as indicated on Drawings; black finish.

C. Wire Fabric:
   1. Provide 2 inch diamond mesh interwoven wire, 9 gauge, 0.1483 inch thick, selvages twisted tight at both top and bottom.
   2. ASTM A392 zinc coated steel chain link fabric.
   3. Comply with CLFMI CLF-PM0610.

D. Concrete:
   1. Ready-mixed, complying with ASTM C94/C94M; normal Portland cement; 2,500 psi strength at 28 days, 3 inch slump; 1 inch maximum size aggregate.

2.02 MANUAL GATES AND RELATED HARDWARE

A. Hardware for Single Swinging Gates: Provide as follows. Coordinate each component with Division 8 Door Hardware specification, and with electrical and security contract documents. Gate operation shall be by presentation of credential at card reader to release electric strike, or via key in night latch rim cylinder. Free egress from interior via push lever exit device at all times. Finish shall be selected from manufacturer's full range except as indicated.
   1. Hinge/Closer Set: Provide heavy-duty exterior grade gate closer/hinge combo at top hinge, suitable for minimum 440 lb gate load; provide with additional hinge at bottom. Basis-of-Design is Locinox; Mammoth 180 degree; black finish.
   2. Exit Device: Provide exterior grade exit device with grooved/textured trim and with night-latch pull-side trim. Exit device shall have waterproof, request-to-exit function. Basis-of-Design: Von Duprin WP-RX-99L-NL x 996L-NL. Size for gate width indicated.
   3. Rim Cylinder: Provide exterior grade rim cylinder compatible with latchway and compliant with keyway system; coordinate with Division 8 "Door Hardware."
   4. Electric Strike: Exterior Grade, surface mounted electric strike with decorative, tapered cover; compatible with rim exit device. Provide with manufacturer's standard latchbolt strike monitor, and with manufacturer's standard power controller to protect unit from power surge.
   5. Power Supply: Dual voltage, 2 Amp power supply.
   6. Wiring Harness: Manufacturer's standard plug-and-play type.

7. Position Switch: Exterior grade, surface mounted; magnetic contacts mounted on push side (interior; secure side) of gate.
8. Coordinate with Electrical and Security Drawings and Division 26, 27, and 28 specifications for intercom and card reader components and coordinate mounting elements to fence as required.

B. Infill Security Panel: Provide solid galvanized plate infill panel, minimum 1/16 inch thick and with black finish to match gate/fence finish. Size to full width of gate and extending minimum of 16 inches above and below exit device to prevent entry from exterior by reaching through and operating exit device.
1. Fence Infill: Provide minimum 12 inch wide infill panel on fence on each side of gate; height to match gate panel. Mount to fence on each side of gate to prevent exit device operation from either side.
2. Bolt security panel to fence/gate with tamper resistant bolts; with bolts and heads color-matched.

2.03 AUTOMATIC GATE OPERATORS

A. Sliding Gates: Pre-wired, pedestal mounted gate operator for horizontal sliding gates, per ASTM F2200 and UL 325.
1. Class: Class II.
2. Operating type: Drive belot or roller chain. Provide with emergency manual crank handle.
3. Control Functions: Open, Pause, Close.
4. Maximum Open/Close Time: 10 seconds.
5. Access: Card.
6. Maximum Gate Weight: 500 pounds (187 kilograms).
7. Electrical Requirements: 208/240 V; 3 Ph, 60 Hz.
8. Horsepower Rating: 1 HP; manufacturer to verify and provide suitable for connected load.
9. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
a. Primary Device: Provide electric sensing edge, wireless sensing, or NEMA 4X photo eye sensors as required with momentary-contact control device.
b. Secondary Device: Provide non-monitored safety edge along leading-edge with continuous-constant control device.
10. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
a. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

2.04 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

2.05 FINISHES

A. Components and Fabric: Except where indicated, provide vinyl-polymer coated over coating of 1.8 ounces per square foot galvanizing in accordance with ASTM F668.

B. Accessories: Same finish as framing.

C. Vinyl-polymer Color: Black.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that areas are clear of obstructions or debris.

3.02 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Place fabric on outside of posts and rails.

C. Set intermediate, terminal, and gate posts plumb, in concrete footings with top of footing at grade level; coordinate with 18 inch mow strip on each side of fence.

D. Post Footing Depth Below Finish Grade: Calculate and install per ASTM F567, but not less than that shown on Drawings.

E. Brace each gate and corner post to adjacent line post with horizontal center brace rail. Install brace rail one bay from end and gate posts.

F. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

G. Do not stretch fabric until concrete foundation has cured 28 days.

H. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

I. Position bottom of fabric 2 inches above finished grade.

J. Fasten fabric to top and bottom rails, line posts, and braces with tie wire at maximum 15 inches on centers.

K. Do not attach the hinged side of gate to building wall; provide gate posts.

L. Install hardware and gate with fabric and barbed wire overhang to match fence.

M. Peen all bolts upon installation.

N. Install gate operators in accordance with manufacturer's instructions and in accordance with NFPA 70.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Position: 1 inch.

3.04 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

C. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

B. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Location: At project site.

END OF SECTION 323114

SECTION 32 92 00 – LAWNS AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fine grading and preparing lawn areas (including courtyards)
2. Topsoil Placement
3. Soil amendments
4. Fertilizers
5. Seeding
6. Meadow grasses and wildflowers
7. Lawn Restoration

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Lawns: All areas disturbed by construction and not otherwise covered by paving, buildings or other structures.

1.4 SUBMITTALS

A. Certification by product manufacturer that the following products supplied comply with requirements:

1. Grass Seed
   a) Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
   b) Blue Tag Certification tag for each bag of seed.

B. Installers qualifications

1. Provide a list, with references, of the past three projects of a similar magnitude.

C. Topsoil Amendment Plan.

1. Provide copy of topsoil testing report.
2. List of amendments proposed for topsoil, including application rates.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer, who has successfully completed lawn and meadow establishment projects similar in size and complexity to this project. The installer's primary business (defined as a minimum of 60% of total billings) shall be establishment of lawns. Engage an experienced installer, who has successfully completed meadow establishment projects similar in size and complexity to this project. The installer's primary business (defined as a minimum of 60% of total billings) shall be establishment of lawns and meadows.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

1.7 COORDINATION AND SCHEDULING

A. Planting Season: Sow lawn seed during normal planting seasons for type of lawn work required.

1. Spring Planting Season: March 15 through May 15
2. Fall Planting Season: September 15 through November 15

B. Weather Limitations: Proceed with planting only when existing and forecast weather conditions are suitable for work.

C. Lawn Seeding Schedule

1. Refer to the drawings for early seeding requirements for specified lawn areas.
2. If job completion schedule does not allow seeding within a normal planting season, provide interim temporary seeding necessary to stabilize site. Complete permanent seeding during the next planting season.

D. Meadow Seeding Schedule

1. Refer to the drawings for early seeding requirements for specified lawn areas.
2. If job completion schedule does not allow seeding within a normal planting season, provide interim temporary seeding necessary to stabilize site. Complete permanent seeding during the next planting season
3. March 1 through May 15
4. May 16 through June 15 with supplemental watering to ensure plant establishment and annual nurse crop of Winter Oats. Apply Winter Oats at 1/3 its typical application rate 24 lbs. /acre. Do not use cereal rye.
5. June 16 through March 1 is not approved for installation.

1.8 LIMITS OF SEEDING

A. Prepare soil and seed all disturbed areas with mix appropriate to locations as indicated on Landscape Plan.

B. Hydroseed all slopes 3:1 and steeper

1.9 LIMITS OF LAWN RENOVATION

A. All existing lawn areas disturbed by construction activities.

B. The areas under the existing modular buildings removed by the Owner.

1.10 PAYMENT PROCEDURES FOR LAWNS AND GRASSES

A. Establish a line item in the Schedule of Values for Lawn Maintenance. This line item shall represent a minimum of thirty percent (30%) of the total value of the seeding for the project.

B. Lawn maintenance will be paid on a monthly basis, following the satisfactory maintenance of the lawns.

PART 2 – PRODUCTS

2.1 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1" or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, stones, clay lumps, and other extraneous materials harmful to plant growth.
   a) Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

B. Have topsoil tested by a certified soil testing laboratory to determine the type and quantity of soil amendments necessary. Add amendments to topsoil as necessary to meet these requirements.

2.2 INORGANIC SOIL AMENDMENTS

A. If the topsoil analysis indicates the need for inorganic soil amendments, the following standards apply:

B. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class O, with a minimum 95 percent passing through No. 8 (2.36-mm) sieve and a minimum 55 percent passing through No. 60 (0.25-mm) sieve.
2. Provide lime in form of dolomitic limestone.

C. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 (3.35-mm) sieve and a maximum 10 percent passing through No. 40 (0.425-mm) sieve.

D. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

E. Aluminum Sulfate: Commercial grade, unadulterated.

F. Perlite: Horticultural perlite, soil amendment grade.

G. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

H. Sand: Clean, washed, natural or manufactured, free of toxic materials.

I. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. If the topsoil analysis indicates the need for organic soil amendments, the following standards apply:

B. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch (19-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
3. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
4. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
5. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.4 HERBICIDES

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.5 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in topsoil analysis reports from a qualified soil-testing agency.
2. Minimum Composition: No less than 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2.6 SEED

A. Grass Seed: All grass seed must be fresh, clean, and dry.

B. Seed Species

Proportion by Weight	Grass Species	Min. % Germination	Min. % Pure Seed	Max. % Weed Seed
10%	Kentucky bluegrass (Poa pratensis).	80	85	0.50
90%	Tall Fescue (Festuca arundinacea).	85	98	0.50

C. Varieties shall be selected from the 2003-2004 list of recommended turfgrass varieties, published by Virginia Tech.

D. All seed shall be Blue Tag certified by the Oregon State Seed Laboratory. Tags must be attached to each bag delivered on site.

2.7 MEADOW GRASSES AND WILDFLOWERS

A. Wildflower and Native-Grass Seed: Fresh, clean, and dry new seed, of mixed species as follows:

1. Low-Growing Wildflower & Grass Mix (ERNMX-156) available from Ernst Conservation Seeds, Inc.

Proportion by Weight	Grass Species	Min. % Germination	Min. % Pure Seed	Max. % Weed Seed
65.60 %	Festuca ovina, Variety Not Stated (Sheep Fescue, Variety Not Stated)	97	100	0
17.00 %	Lolium multiflorum (Annual Ryegrass)	80	100	0
8.00 %	Linum perenne ssp. Lewisii (Perennial Blue Flax)	80	100	0
3.00 %	Chrysanthemum maximum (Shasta Daisy)	50	100	0
2.00 %	Coreopsis lanceolata (Lanceleaf Coreopsis)	50	100	0
2.00 %	Rudbeckia hirta, Coastal Plain NC Ecotype (Blackeyed Susan, Coastal Plain	50	100	0

	NC Ecotype)			
0.50 %	Achillea millefolium (Common Yarrow)	50	100	0
0.50 %	Asclepias tuberosa, PA Ecotype (Butterfly Milkweed, PA Ecotype)	50	100	0
0.30 %	Chamaecrista fasciculata, PA Ecotype (Partridge Pea, PA Ecotype)	50	100	0
0.30 %	Eupatorium coelestinum, VA Ecotype (Mistflower, VA Ecotype)	50	100	0
0.10 %	Aster divaricatus, PA Ecotype (White Wood Aster, PA Ecotype)	50	100	0
0.10 %	Aster oblongifolius, PA Ecotype (Aromatic Aster, PA Ecotype)	50	100	0
0.10 %	Aster prenanthoides, PA Ecotype (Zigzag Aster, PA Ecotype)	50	100	0
0.10 %	Baptisia tinctoria, PA Ecotype (Yellow False Indigo (Horseflyweed), PA Ecotype)	50	100	0
0.10 %	Penstemon hirsutus (Hairy Beardtongue)	50	100	0
0.10 %	Pycnanthemum tenuifolium (Narrowleaf Mountainmint)	50	100	0
0.10 %	Rudbeckia fulgida var. fulgida, Northern VA Ecotype (Orange Coneflower, Northern VA Ecotype)	50	100	
0.10 %	Tradescantia virginiana, Southeastern PA/Northern VA (Virginia Spiderwort, Southeastern PA/Northern VA blend)	50	100	0

A. Meadow mix rates are calculated as Pure Live Seed (PLS). Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

B. All seed must meet the requirements of the Virginia State Seed Law. All seed shall be subject to retesting by a recognized seed laboratory. All Seed used must have been tested within the 6 months immediately preceding the date of sowing. Seed tags must be available upon request to the inspector to verify type of seed and seeding rate.

C. Seed Carrier: Inert material, sharp clean sand or perlite.

2.2 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Peat Mulch: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

C. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 percent of dry weight.

D. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

2.3 EROSION-CONTROL MATERIALS

A. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and for conditions affecting performance of the Work. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Protect adjacent and adjoining areas from hydroseed overspraying.

D. Eradicate existing vegetation if present through either herbicide application and/or tillage

1. If tilling, complete two tillage operations to an average depth of 2-4 inches with one to two weeks in between each operation.
2. If applying herbicide, complete two applications of a non-selective herbicide which does not leave an active soil residual with one to two weeks between each application
   a) Close mowing two weeks prior to spraying is recommended to stimulate weed growth.

E. Meadow

1. Graded areas must be maintained in a true and even grade as specified on the approved plan, then scarified or otherwise loosened to a depth of 3 to 5 inches with a disc, by dragging with a heavy chain, or using other equipment.
2. On slopes 3:1 or steeper, scarify the soil surface with a bulldozer, heavy chain or other equipment to loosen the soil 1 inch deep. Following the general contour when preparing the final surface.
3. All rocks and other debris larger than 2 inch in diameter shall be removed
4. Mix soil amendments into the top 3 to 5 inches of soil by disking or other suitable means.
5. Track slopes 3:1 or flatter with tracked equipment leaving the soil in an irregular condition with ridges running parallel to the contour of the slope. Leave the top 1 to 3 inches of soil loose and friable. Seedbed loosening may be unnecessary on newly disturbed areas.

3.3 TOPSOIL PLACEMENT FOR LAWNS

A. Limit subgrade preparation to areas that will be planted in the immediate future.

B. Loosen subgrade to a minimum depth of 4 inches. Remove stones, sticks and roots larger than 2 inches in any dimension from subgrade. Completely remove trash and other extraneous debris from subgrade.

C. Have topsoil tested by a certified soil testing laboratory to determine the type and quantity of soil amendments necessary.

D. Sift topsoil to remove stones and other objects larger than 1" in any dimension. Maximum object size for topsoil shall be achieved by sifting not by hand removal or raking following placement of topsoil.

E. Mix soil amendments and fertilizers with topsoil at rates required by soil testing. Delay mixing fertilizer if planting does not follow placing of planting soil within 4 days. Either mix soil before spreading or apply soil amendments on surface of spread topsoil and mix thoroughly into top 4 inches of topsoil before planting.

F. Mix lime with dry soil prior to mixing fertilizer.

G. Spread topsoil to a minimum depth of six inches (6").

3.4 SEEDING LAWNS

A. Sow seed with a spreader or a seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.

B. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

C. Sow seed at the following rates:

2. Seeding Rate: 200 lbs./acre.

D. Rake seed lightly into top 1/4 inch of topsoil, roll lightly, and water with fine spray.

E. Hydroseed all slopes 3:1 or steeper.

F. Protect seeded areas 3:1 slope/grade or steeper against erosion by providing erosion-control blankets installed and stapled according to manufacturer's recommendations.

G. Protect seeded areas less than 3:1 slope/grade against erosion by spreading straw mulch after completion of seeding operations. Spread uniformly at a minimum rate of 2 tons per acre to form a continuous blanket 1-1/2 inches loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into topsoil by suitable mechanical equipment.

3.5 LAWN RENOVATION

A. Renovate existing lawn. Limits of existing lawn to be renovated are indicated on the drawings.

B. Renovate existing lawn damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish lawn where settlement or washouts occur or where minor regrading is required.

C. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury in soil.

D. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.

E. Mow, de-thatch, core aerate, and rake existing lawn.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top 4 inches of existing soil. Provide new planting soil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new lawns.

K. Water newly planted areas and keep moist until new lawn is established.

3.6 MAINTENANCE OF NEW LAWNS

A. Begin maintenance of lawns immediately after each area is planted and continue for a period of one year after the date of Final Completion. Maintain all grassed areas as necessary to ensure a satisfactory lawn is achieved.

B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

1. Replant bare areas with same materials as for lawns.
2. Replace disturbed mulch.

C. Watering: Provide and maintain temporary hoses, and lawn-watering equipment to convey water from a water source to keep lawns uniformly moist to a depth of 4 inches.

1. Provide a source of water for irrigation. Utilize temporary irrigation meters, a well or water trucks as necessary for the water source.

2. Water seeded areas as necessary to promote vigorous growth of grass but at the minimum rate of 1 inch per week.

D. At a minimum, the following fertilizer applications are required:

1. By November 30, 2001, apply 15-5-10 commercial fertilizer at the rate of 200 lbs. per acre over all seeded areas.
2. By March 30, 2002, apply 15-5-10 commercial fertilizer at the rate of 350 lbs. per acre over all seeded areas.
3. By November 30, 2002, apply 15-5-10 commercial fertilizer at the rate of 200 lbs. per acre and apply lime at 2000 lbs. per acre over all seeded areas.
4. Provide written acknowledgement that this requirement has been met prior to requesting Substantial Completion.

E. Mow lawns as soon as there is enough top growth to cut with mower set at indicated height. Repeat mowing as required to maintain indicated height without cutting more than 40 percent of the grass height (minimum of 3 mowings). Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain following grass height:

1. Mow grass to a finished height of 2 to 3 inches high.

F. Apply pre-emergent herbicide to lawns areas. Apply 60 – 90 days after planting.

3.7 SATISFACTORY LAWN

A. Seeded lawns shall be considered satisfactory/acceptable provided requirements, including maintenance, have been met and a healthy, uniform, close stand of grass is established, free of weeds, bare spots exceeding 5 by 5 inches, and surface irregularities.

B. Sodded lawns shall be considered satisfactory/acceptable provided requirements, including maintenance, have been met and a healthy, well-rooted, even-colored, viable lawn is established, free of weeds, open joints, bare areas and surface irregularities.

C. Replant lawns that do not meet requirements and continue maintenance until lawns are satisfactory/acceptable.

D. Substantial Completion of the building and the remainder of the project may be achieved (pending prior Owner and Owner approval) before achieving a satisfactory/acceptable lawn. Continue to replant and maintain unsatisfactory/unacceptable lawn areas until acceptance is obtained. Warranties for lawns shall begin at the time of acceptance of the lawn.

3.8 SEEDING MEADOW

A. Hand seed, drill or dry broadcast with a spreader or seeding machine.

1. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
2. Before sowing, mix seed with seed carrier at a ratio of not less than two parts seed carrier to one-part seed.
3. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Apply half the seeding rate in each direction.
4. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Hydroseeing: extra care must be taken when hydroseeding in order to ensure native wildflower germination.

1. The application should incorporate wildflower seed into a low mulch slurry to ensure proper seed/soil contact and avoiding seed suspension in upper mulch layer (which prevents germination).
2. Follow seeding schedule when hydroseeding.
3. Add fiber mulch and tackifier per manufacturer instructions.

C. Sow seed at a total rate of 20 to 40 pounds per 1 acre.

D. Brush seed into top 1/16 inch of soil, roll lightly, and water with fine spray.

E. Rake or drag seed to the required depth and ensuring seed-to-soil contact. No raking or dragging is necessary in wet applications.

F. Water newly planted areas and keep moist until meadow is established.

3.9 MAINTENANCE OF MEADOW

A. Maintain and establish meadow by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable meadow.

Roll, regrade, and replant bare or eroded areas and remulch. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and meadow damaged or lost in areas of subsidence.
2. Apply treatments as required to keep meadow and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
3. Control invasions by undesirable plants by pulling, mowing or spraying with a selective herbicide until establishment of acceptable meadow.

B. Watering: Install and maintain temporary piping, hoses, and meadow-watering equipment to convey water from sources and to keep meadow uniformly moist.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. If a minimum ¼ inch of rainfall is not received within 10 days after seeding, irrigate with a minimum of ¼ inch of water.
3. Provide supplemental moisture if and when necessary to assure early survival and establishment of ecolawn and meadow.

C. First-year maintenance

a) When Meadow reaches 18 to 24 inches tall, using a string trimmer, trim to a height of 8 inches. Repeat procedure to limit growth above 24 inches. Cease trimming by the middle of September.

b) Replant all areas with less than 40% ground cover by following the original seedbed preparations, amendment and seeding recommendations

c) Replant all areas with between 40% and 85% cover by over-seeding at half the original rate.

D. Second-year/General maintenance (by Owner)

1. Spray undesirable weeds with an approved aquatic selective herbicide as needed.

3.10 SATISFACTORY MEADOW

A. All Meadow areas shall be considered satisfactory/acceptable provided requirements, including maintenance, have been met and a healthy, uniform, close stand of desired vegetation is established and no–bare spots exceeding 5 by 5 inches or any surface irregularities.

B. Replant meadows that do not meet requirements and continue maintenance until meadow is satisfactory/acceptable by Contracting Officer.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from sidewalks and paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period as needed until lawn is established.

END OF SECTION 32 9200

SECTION 32 93 00 - EXTERIOR PLANTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Trees
2. Shrubs
3. Groundcovers
4. Other Plant Materials
5. Stakes & Guys

1.3 SUBMITTALS

A. Installers Qualifications: Provide a list, with references, of the past three projects of similar scope.

B. Product Data: For each type of product indicated.

C. Plant Material Certifications:

1. Certificates of inspection as required by governmental authorities.
2. Label data substantiating that plant materials comply with specified requirements.

D. Planting Schedule:

1. Typewritten planting schedule.
2. Once accepted, revise dates only as approved in writing and submitted to Owner.

E. Maintenance Schedules: Typewritten instructions recommending procedures for maintenance of landscape work for one full year. Submit prior to completion of project.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer, who has successfully completed planting projects similar in size and complexity to this project. The installer's primary business (defined as a minimum of 60% of total billings) shall be exterior plant installation.

B. Installer's Field Supervision: Installer to maintain an experienced full-time supervisor on the project site when exterior planting is in progress.

C. Exterior Plant Materials:

1. Provide plant materials of quantity, size, genus, species, and variety indicated on the Drawings.
2. All plant materials and work shall comply with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock."
3. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to Owner, together with proposal for use of equivalent material.
4. The Owner may inspect plant materials either at place of growth or on site before planting, for compliance with requirements for genus, species, variety, size, and quality. Owner retains right to further inspect trees for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees immediately from project site.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials:

1. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer or grower.
2. Protect materials from deterioration during delivery, and while stored at site.

B. Exterior Plant Materials

1. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.
2. Deliver exterior plant materials after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set plant materials in shade, protect from weather and mechanical damage, and keep roots moist and free from frost.
3. Do not remove container-grown stock from containers until planting time.
4. Balled and burlapped material shall be freshly dug.
5. Handle planting stock by root ball.

1.6 PROJECT CONDITIONS

A. Examine the subgrade, verify the elevations, and observe the conditions under which work is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate as required.

C. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Owner before planting.

D. Provide all necessary safeguards for the protection of all planted areas until provisional inspection/acceptance is accomplished.

E. Planting Restrictions: Plant during one of the following periods.

1. Spring Planting: Unfrozen soil conditions March 1-June 1st.
2. Fall Planting: September 1-November 1st or until frozen soil conditions prevent work.
3. Summer Planting: June 1 – September 1 with approved irrigation system.

F. Coordination with Lawns: Install plant materials after finish grades are established and before planting lawns, unless otherwise acceptable to the Owner.

1. When planting exterior plants after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.7 WARRANTY

A. Warranty exterior plant materials for a period of one year after date of Final Completion against defects including death and unsatisfactory growth, except for abuse or damage by others, or unusual phenomena or incidents which are beyond Contractor's control.

1. The Contractor shall provide written notice to the Owner of any practice which will affect the warranty if not remedied promptly. The Owner will render an opinion of the conflict if necessary.
2. Make replacements of all dead plants or plants in impaired condition (more than 25% dead or dying) condition in early spring/fall following installation. Replacements of dead or rejected plants should again be made prior to the expiration of the warranty period.

1.8 MAINTENANCE

A. The Contractor is responsible for maintaining all exterior plant material for a period of one year after the date of Final Completion.

B. Remove all stakes and guy wires at the end of the 12-month guarantee period.

PART 2 – PRODUCTS

2.1 EXTERIOR PLANT MATERIALS

A. General: Provide nursery-grown plant materials complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

2.2 PLANTS

A. Annuals: Provide healthy, disease-free plants of species and variety indicated. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom

B. Perennials: Provide healthy, field-grown plants from a commercial nursery of species and variety shown or listed.

C. Vines: Provide plants with heavy, well-branched tops, with not less than three runners and a vigorous well-developed root system.

2.3 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium. Revise fertilizer mix to remedy deficiencies found in soil.

1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium. Revise fertilizer mix to remedy deficiencies found in soil.

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.4 MULCHES

1. Organic Mulch: Six (6) month old well rotted double shredded native hardwood bark mulch not larger than 4" in length and 1/2" in width, free of woodchips and sawdust.

2.5 WATER

1. Free of substances harmful to plant growth.

2.6 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content. Topsoil shall be fertile, friable, natural topsoil of loamy character, without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay, lumps, coarse sands, stones, plants, roots, sticks and other foreign materials.

B. Topsoil Source:

1. Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

   a) Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land**,** bogs or marshes.

2. Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land**,** bogs or marshes.

3. Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

   a) Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

2.7 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.
2. Class: Class O, with a minimum 95 percent passing through No. 8 (2.36-mm) sieve and a minimum 55 percent passing through No. 60 (0.25-mm) sieve.
3. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 (3.35-mm) sieve and a maximum 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.8 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch (19-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; bio-solids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Sphagnum peat moss: Sphagnum peat moss shall be partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives mix partially decomposed wood derivatives with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb (4 kg) of ammonium sulfate per cubic foot (cubic meter) of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, poultry, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.9 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Tree save areas as indicated shall be tagged and approved by the Owner prior to any clearing and/or thinning.

B. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Owner's acceptance of layout before planting. Make minor adjustments as required.

E. Lay out exterior plants at locations indicated. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

3.3 PLANTING BED ESTABLISHMENT

A. Loosen subgrade of planting beds to a minimum depth of 4 inches (100 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off of Owner's property.

1. Apply fertilizer directly to subgrade before loosening.
2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
    a) Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    b) Mix lime with dry soil before mixing fertilizer.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.4 TREE AND SHRUB PLANTING

A. Set all plant materials plumb and in center of pit or trench as per detail.

1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
4. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling and maintain plumb while working backfill around roots and placing layers above roots. Tamp final layer of backfill. Remove injured roots by cutting cleanly, do not break.
5. Dish top of backfill to allow for mulching.

B. Organic Mulching: Apply 3-inch (75-mm.) average thickness of organic mulch extending 12 inches (300 mm) beyond edge of planting pit or trench. Do not place mulch within 3 inches (75 mm) of trunks or stems.

3.5 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as indicated.

3.6 PERENNIAL AND GROUND COVER PLANTING

A. Set out and space ground cover and plants as indicated in details.

B. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

3.7 CLEANUP AND PROTECTION

A. During exterior planting, keep adjacent pavings and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

3.8 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 32 9300

SECTION 33 10 00 – EXTERIOR WATER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This section includes water service piping, fire protection service mains and appurtenances from the source of water to a point 5 feet outside the building.

1.3 SUBMITTALS

A. Product data for piping, valves, vaults, fire hydrants, and identification devices.

1.4 QUALITY ASSURANCE

A. Comply with local utility department and fire department standards pertaining to materials, meter boxes, hose threads and installation.

B. Comply with the requirements of the latest edition of the Virginia Department of Health and City of Staunton's Public Works.

1.5 DELIVERY, STORAGE, AND HANDLING

1.6 PROJECT CONDITIONS

A. Preparation for Transport: Prepare valves, including fire hydrants, for shipping as follows.

1. Ensure valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends, flange faces, and weld ends.
3. Set valves in best position for handling. Set gate valves and fire hydrants closed to prevent rattling.

B. Storage: Use the following precautions for valves, including fire hydrants, during storage:

1. Do not remo`ve end protectors unless necessary for inspection; then reinstall for storage.

2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

C. Handling: Use a sling to handle valves, including fire hydrants, whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with interior water piping and interior fire protection piping.

B. Coordinate with other utility work.

C. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions:

1. Notify engineer not less than two days in advance of the proposed interruption.
2. Do not proceed with the interruption without engineer's written permission.
3. Provide temporary utility service to the facility.

PART 2 - PRODUCTS

2.1 GENERAL

A. All piping, valves, fittings, fire hydrants, meters, meter vaults, appurtenances and other products shall conform to the requirements of the latest edition of the Virginia Department of Health and City of Staunton's Public Works.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of the exterior water system shall comply with the requirements of the latest edition of the Virginia Department of Health and City of Staunton's Public Works.

3.2 PREPARATION OF BURIED PIPE FOUNDATION

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated level.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.3 PIPE AND PIPE FITTING INSTALLATION

A. Depth of Cover: Provide minimum cover over piping of 36 inches below finished grade.

B. Water Service Termination: Terminate water service piping 5'-0" from building foundation in location and invert as indicated. Coordinate location with interior water piping and interior fire service piping. Provide temporary pipe plug for piping extension into building.

3.4 IDENTIFICATION INSTALLATION

A. Install underground warning tape and tracing wire for underground water service piping, as required by the latest edition of the Virginia Department of Health and City of Staunton's Public Works.

3.5 FIELD QUALITY CONTROL

A. Testing and Disinfection: Disinfect, flush and test in accordance with the requirements of the latest edition of the Virginia Department of Health and City of Staunton's Public Works.

END OF SECTION

SECTION 33 30 00 - SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes sanitary sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal.

1.3 SUBMITTALS

A. Product data for sewer piping specialties.

B. Shop drawings for precast concrete sanitary manholes, including frames and covers.

C. Shop drawings for cast-in-place concrete or field-erected masonry sanitary manholes, including frames and covers.

D. Inspection and test reports specified in the "Field Quality Control" Article

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems, and to the requirements of the Virginia Erosion and Sediment Control Handbook for erosion control during installation.

B. Utility Compliance: Comply with the requirements of the latest edition of the City of Staunton's General Water and Sewer Construction Specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

1. Do not store plastic structures in direct sunlight.
2. Do not store plastic pipe or fittings in direct sunlight.
3. Protect pipe, pipe fittings, and seals from dirt and damage.
4. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.
5.

1.6 PROJECT CONDITIONS

A. Site Information: Perform site surveys, research public utility records, and verify existing utility locations. Verify that sanitary sewerage system piping may be installed in compliance with original design and referenced standards.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Owner not less than 48 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without receiving Owner's written permission.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with interior building sanitary drainage piping.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. General: Provide pipe and pipe fitting materials compatible with each other. All materials shall comply with the requirements of the latest edition of the City of Staunton's General Water and Sewer Construction Specifications.

B. PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM D 3034, SDR 35, elastomeric gasket joints.

1. Gaskets: ASTM F 477, elastomeric seal.

C. Ductile-Iron Pipe: AWWA C151, Class 50 minimum, for push-on joints.

1. Standard-Pattern, Ductile-Iron and Cast-Iron Fittings: AWWA C110, for push-on joints.
2. Compact-Pattern, Ductile-Iron Fittings: AWWA C153, for push-on joints.
3. Pipe and Fitting Interior Coating: AWWA C104, asphaltic-material seal coat, minimum 1-mil (0.025-mm) thickness.
4. Gaskets: AWWA C111, rubber.

2.2 MANHOLES

A. Precast Concrete Manholes: Shall comply with the latest edition of the City of Staunton's General Water and Sewer Construction Specifications.

B. Manhole Steps shall comply with the latest edition of the Local Utility Standards.

C. Manhole Frames and Covers: Shall comply with the latest edition of the Local Utility Standards.

2.3 CLEANOUTS

A. General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.

B. Sewer pipe fitting and riser to cleanout: 4" dia. ductile iron pipe.

PART 3 - EXECUTION

3.1 PREPARATION OF FOUNDATION FOR BURIED SANITARY SEWERAGE SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated level.

C. Install pipe bedding as required by the latest edition of the City of Staunton's General Water and Sewer Construction Specifications.

3.2 PIPE INSTALLATION

A. Install the sanitary sewerage system in accordance with the requirements of the latest edition of the Local Utility Standards.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install piping pitched down in direction of flow, at minimum slope of 2 percent, except where indicated otherwise.

F. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated.

3.3 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. Join and install PVC pipe as follows:

1. Pipe and gasketed fittings, joining with elastomeric seals, in accordance with ASTM D 3212.
2. Installation in accordance with ASTM D 2321.

B. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.4 MANHOLES

A. Install precast concrete manholes in accordance with the latest edition of the Local Utility Standards.

B. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.

C. Apply bituminous mastic coating at joints of sections.

3.5 CLEANOUTS

A. Provide cleanouts as indicated, and as required by authorities having jurisdiction. Set cleanout frame and cover in concrete block 12 by 12 by 6 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grades or flush with grade when installed in paving.

3.6 FIELD QUALITY CONTROL

A. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
3. Flush piping between manholes, if required by local authority, to remove collected debris.

B. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects, and reinspect.

C. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to the requirements of the Local Utility Standards.
3. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours' advance notice.
4. Submit separate reports for each test.

END OF SECTION 33 3000

SECTION 33 41 00 – STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplemental Conditions and other Division 1 Specifications Sections, apply to this section.

1.2 SUMMARY

A. This Section includes the roof drainage collection system, the storm sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal, and the outfall structures of the stormwater management basin.

1.3 SUBMITTALS

A. Product data for:

1. Concrete pipe
2. Polyethylene pipe
3. Ductile iron pipe
4. Frames and covers
5. Grates

B. Certification, signed by material producer and contractor, that standard precast and cast in place concrete storm drainage manholes and Drop Inlets comply with VDOT standards and specifications.

C. VDOT approved job mix for bedding stone.

D. Shop drawings for:

1. Non-standard precast or cast-in-place concrete storm drainage manholes and Drop Inlets.
2. Cleanouts
3. Underdrains
4. Stormwater Management Basin Outlet structures, including: Riser pipe, outfall pipe, riser anchoring, anti-seep collars, trash rack and anti-vortex device.

E. Record drawings of installed storm drainage system.

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm sewerage systems.

B. Utility Compliance: Comply with state and local regulations and standards pertaining to storm sewerage systems.

C. All materials shall be new and free of defects (i.e. pipe shall not have chipped spigots or bells).

1.5 PROJECT CONDITIONS

A. Site Information: Perform site surveys, research public utility records, and verify existing utility locations. Verify that storm sewerage system piping may be installed in compliance with original design and referenced standards.

B. Locate existing structures and piping to be removed.

C. Existing Utilities: Do not interrupt existing storm sewer serving offsite property owners except when permitted under the following conditions and then only after arranging to provide acceptable temporary storm sewer services.

1. Notify engineer not less than 48 hours in advance of proposed storm sewer interruptions.
2. Do not proceed with storm sewer interruptions without receiving engineer's written permission.

D. Existing utilities across or along the line of work are indicated only in an approximate location. Locate all underground lines and structures. Call "Miss Utility" prior to construction. If utilities are marked that are not shown on the plans, locate utility vertically and horizontally and provide information to engineer.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate with interior building storm drainage piping.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials used for construction of the storm sewerage system shall comply with the requirements of the latest edition of the Virginia Department of Transportation Road and Bridge Standards and Road and Bridge Specifications.

2.2 PIPE AND FITTINGS

A. Provide pipe and pipe fitting materials compatible with each other. Pipe materials are indicated on the drawings.

B. Reinforced Concrete Pipe (RCP): Shall conform to the requirements of ASTM C76/AASHTO M170, Class III, unless otherwise indicated.

C. O-Ring Gasket Reinforced Concrete Pipe: Shall conform to the requirements of ASTM C76/AASHTO M170, Class III, unless otherwise indicated. Joints shall conform to the requirements of ASTM C443/AASHTO M198.

D. Corrugated Polyethylene Pipe (P.E.): Shall have a smooth lined interior and meet the requirements of ASTM F405 or AASHTO M252 for 10" diameter and smaller, and ASTM F667 or AASHTO M294 for 12" diameter and larger.

E. PVC Storm Sewer Pipe: Shall conform to the requirements of ASTM D3034, SDR-35 with bell and spigot ends for gasketed joints with ASTM F 477 elastomeric seals

1. Connections to the building downspouts shall be made with Schedule 40 PVC.

F. Ductile Iron Storm Sewer Pipe: Shall conform to the requirements of AWWA C151, Class 52. Flanged joints shall conform to the requirements of AWWA C115.

2.3 MANHOLES

A. Precast Concrete Manholes: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

B. Cast in Place Manholes: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

C. Manhole Steps, Safety Slabs and Inlet Shaping: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

2.4 CLEANOUTS

A. Cast iron ferrule and countersunk brass cleanout plug, with round cast iron access frame and heavy duty, secured, scoriated cast iron cover.

2.5 DROP INLETS

A. Precast Concrete Drop Inlets: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

B. Cast in Place Drop Inlets: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

C. Drop Inlet Steps, Safety Slabs and Inlet Shaping: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

D. Drop Inlet Frames and Grates: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

E. Plastic Drain Basins: ADS 2812AG or approved equal.

2.6 CONCRETE AND REINFORCEMENT

A. Concrete: Conform to the requirements of VDOT Standard Class A3 concrete.

B. Reinforcement: Steel conforming to the following:

1. Fabric: ASTM A 185 welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615, Grade 60, deformed.

2.7 UNDERDRAINS

A. Underdrains and combination underdrains: Conform to the requirements of the latest edition of the VDOT Road and Bridge Specifications and the VDOT Road and Bridge Standards for the type of underdrain, unless otherwise indicated.

1. PVC underdrains shall conform to the requirements of ASTM F758, Type PS 28 or ASTM F949.
2. PE corrugated underdrain pipe shall conform to AASHTO M252.

B. Provide a filter fabric "sock" wrapping for all underdrain pipe.

PART 3 - EXECUTION

3.1 GENERAL

A. Install the storm sewerage system in accordance with the latest edition of the Virginia Department of Transportation's Road and Bridge Standards and Road and Bridge Specifications.

3.2 PREPARATION OF BURIED PIPE FOUNDATION

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated level.

C. Install pipe bedding conforming to the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards and Road and Bridge Specifications.

3.3 PIPE INSTALLATION

A. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

B. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

C. Extend storm sewerage system piping to connect to building storm drains, of sizes and in locations indicated.

D. Join and install concrete pipe and fittings per VDOT specifications.

E. Join and install PE pipe and fittings per manufacturer's recommendations.

F. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.4 MANHOLES

A. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channel and benches between inlets and outlet. Set tops of frames and covers flush with finish grade, unless otherwise indicated.

B. Place precast concrete manhole sections as indicated and install in accordance with ASTM C 891.

C. Construct cast in place manholes as indicated.

D. Apply bituminous mastic coating at joints of sections.

3.5 CLEANOUTS

A. Install cleanouts and extension from sewer pipe to clean out at grade as indicated. Set cleanout frame and cover in concrete block 12 by 12 by 6 inches deep, except where location is in concrete paving. Set top of cleanout flush with finish grade.

3.6 DROP INLETS

A. Construct drop inlets to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 INLET SHAPING

A. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
3. Flush piping between manholes and drop inlets to remove collected debris. Flush pipes through an approved erosion and sediment control measure.

B. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
2. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects correct such defects and reinspect.

END OF SECTION

SECTION 33 42 00 – FOUNDATION DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes underground foundation drainage systems, as follows:

1. Footage drainage system.

1.3 SUBMITTALS

A. Product data for each type of foundation drainage material required.

B. Shop drawings for interfacing with total site drainage system.

C. Certification signed by Contractor and foundation drainage system Installer that installed materials conform to requirements and system was successfully check and tested prior to covering with filter fabric and drainage fill.

PART 2 - PRODUCTS

2.1 DRAINAGE PIPE AND FITTINGS

A. Provide drainage pipes complete with bends, reducers, adapters, couplings, collars, and joint materials.

1. Perforated Polyvinyl Chloride Pipe: ASTM D2729.

2.2 SOIL & MISCELLANEOUS MATERIALS

A. General: Bedding, backfill, and porous fill materials are indicated in Section 023000.

B. Filter Fabric: Manufacturers standard non-woven geotextile fabric of polypropylene or polyester fibers, or a combination thereof.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine adjacent surfaces to receive foundation drainage system to verify suitability. Do not being installation until subsurface conditions are satisfactory to accept drainage system.

3.2 INSTALLATION

A. Inspect pipe trench for line, level (or slope as required) and pipe support conditions.

B. Laying Drain Pipe: Lay drainpipe solidly bedded. Provide full bearing for each pipe section throughout its length to true grades and alignments, and continuous slope in direction of flow.

1. Lay perforated pipe with perforations down and joints tightly closed in accordance with pipe manufacturers recommendations. Provide collars and couplings as required.
2. Provide recesses in excavation bottom to receive bells for drainpipe having bell and spigot ends. Lay pipe with bells facing up slope and with spigot end entered fully into adjacent bell. Seal joint in accordance with requirements of local building officials.

C. Test Drain Lines: Test and check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.

D. Drainage Fill: Place drainage fill over drain lines after satisfactory testing. Completely cover drain lines to a width of at least 6 inches on each side of the pipe and a depth of at least of 6 inches above and below the pipe. Place fill material in layers not exceeding 6 inches or less than 3 inches in loose depth and compact each layer placed.

1. Overlay drainage fill material with one layer of filter fabric, overlapping edges at least 6 inches.

E. Fill to Grade: Install fill material over compacted drainage fill at footing drains, placing material in layers not exceeding 6 inches in loose depth and thoroughly compacting each layer.

END OF SECTION

APPENDIX A: ASBESTOS AND LEAD PAINT SURVEY REPORT

The following Asbestos and Lead Paint Survey Report prepared by TRC for the City of Staunton, is dated December 15, 2022 and is included in this Project Manual for information only and is not part of the Contract Documents.

The opinions expressed in these reports are those of the Hazardous Materials Engineer and represent their interpretation of the existing conditions, tests and the results of analyses which they have conducted.

The accuracy or completeness of the data is not warranted or guaranteed by the Owner or the Architect, and in no event is it to be considered part of the Contract Documents. The Owner and Architect expressly disclaim any responsibility for the data as being representative of the conditions and materials which may be encountered.

The data and quantities included in the Hazardous Materials Report shall be used for bidding purposes to determine abatement costs. The Asbestos Abatement Subcontractor shall be responsible for a final inspection of existing conditions to verify location of hazardous materials prior to commencement of demolition.

Note that the survey report contains data and quantities for multiple existing buildings in the commercial shopping center. The Work of this project applies to Building/Space 2032 only. The other buildings on the site are existing to remain.

Refer to the following pages.

ASBESTOS AND LEAD PAINT SURVEY REPORT

Asbestos Inspection Survey

Chestnut Hills Plaza Vacant Commercial Spaces
2024, 2026, 2028, 2030, and 2032
West Beverley Street
Staunton, Virginia

Prepared for:

The City of Staunton, Virginia
and United States Environmental Protection Agency
USEPA Brownfields Assessment Grant Number:
BF-963889-01

Report Date: December 15, 2022

Prepared By:

2200 South Main Street Blacksburg, Virginia 24060

TRC Project: 018244

TABLE OF CONTENTS

EXECUTIVE SUMMARY i
INTRODUCTION 1
BACKGROUND 1
FINDINGS 2
Asbestos Findings 2
XRF Results 3
RECOMMENDATIONS 6
Asbestos Containing Materials 6
Lead Containing Paints 6
DISCLAIMER 6

Appendices

Appendix A – Sample Location Diagrams

Appendix B – Asbestos Workplan

Appendix C – Laboratory Results and Chain of Custody

Appendix D – Field Documentation/Prior Reports

Appendix E – Certifications

EXECUTIVE SUMMARY

contracted TRC Environmental Corporation (TRC) to conduct a limited scope asbestos and lead paint survey.

Asbestos Containing Materials

Results of the bulk sampling indicated the following materials contained asbestos:

1. 88,478 square feet (SF) of black mastic and associated 12”x12” flooring located through the footprint of both Site structures (2024, 2026, 2028, 2030 and 2032).
2. 25,165 SF roof system and silver roof flashing/paint and black roof mastic located on the main roof of the 2028 and 2030 space.
3. 20 SF of gray roof caulk located on the exterior of the 2024 space.
4. 20 SF of HVAC vibration dampener located in the mechanical area of the 2030 space.
5. 50 SF of gray and white window and exterior door caulk located on the exterior of the 2032 space.
6. 25 SF of gray exterior window caulk located on the exterior of the 2026 space.
7. 50 SF of brown expansion joint located in the 2026 space (if owner designates walls for demolition)
8. 250 SF of the red/gray linoleum on the interior wall in the 2030 space.
9. 500 SF of joint compound associated with sheetrock in the 2026 and 2030 space.
10. 25 SF of gray exterior window caulk located on the exterior of the 2032 space.
11. 600 SF black mastic on the wood paneling in the 2032 space.

Lead Containing Paint Sampling Results

Results of the survey completed by TRC indicate that no lead was detected above the reportable limit using an XRF.

INTRODUCTION

contracted TRC Environmental Corporation (TRC) to conduct a limited scope asbestos and lead survey at Chestnut Hills Plaza Vacant Commercial Spaces 2024, 2026, 2028, 2030, and 2032 West Beverley Street Staunton, Virginia. The survey activities were initiated on October 20 and October 21, 2022, by Andre Steuer and Antonio Conde, Asbestos Hazard Emergency Response Act (AHERA) accredited Asbestos Building Inspector(s) and licensed Virginia Asbestos Inspectors.

BACKGROUND

Please note that the asbestos inspection will utilize data from the asbestos inspection conducted in September 2021 by Diversified Environmental Services of Staunton, VA.

Survey Scope of Work

The specific area designated for inspection by the Client consists of five (5) commercial shopping plaza spaces ranging in area from 1,500 square feet to 44,000 square feet.

Asbestos Inspection

TRC reviewed the previous survey prior to completing the fieldwork. Based on our review it was determined that previously identified asbestos needed to be be field verified on its existence and remaining ACM needed to be quantified. Previously identified asbestos materials within the subject buildings include the following:

- Floor Tile
- Mastic Adhesive associated Floor Tile
- Sheet Flooring
- Roofing Field
- Roof Mastic Adhesive
- Roof Flashing
- Window Caulk
- Building Expansion Joints
- Wood Paneling Mastic
- HVAC Vibration Dampers
- Miscellaneous other suspect building materials.

Lead Inspection

TRC identified building components in each structure and randomly selected representative components for lead testing. TRC utilized a non-radioactive, X-ray fluorescence (XRF) analyzer to confirm or dismiss painted surfaces for lead content.

Since the planned use of the space is commercial, paint coatings analyzed by the XRF instrument will be characterized as lead based (i.e., > 1.0 mg/cm^2), lead containing (> 0.0 mg/cm^2 but < 1.0 mg/cm^2) or non-lead containing.

FINDINGS

Asbestos Containing Materials

Results of the bulk sampling and previous sampling data indicated the following materials and quantities:

- 88,478 square feet (SF) of black mastic and associated flooring located through the footprint of both Site structures.
- 25,165 SF roof system and silver roof flashing/paint and black roof mastic located on the main roof of the 2028 and 2030 space.
- 20 SF of gray roof caulk located on the exterior of the 2024 space.
- 20 SF of HVAC vibration dampener located in the mechanical area of the 2030 space.
- 50 SF of gray and white window and exterior door caulk located on the exterior of the 2032 space.
- 25 SF of gray exterior window caulk located on the exterior of the 2026 space.
- 50 SF of brown expansion joint located in the 2026 space (if owner designates walls for demolition)
- 250 SF of the red/gray linoleum on the interior wall in the 2030 space.
- 500 SF of joint compound associated with sheetrock in the 2026 and 2030 space.
- 25 SF of gray exterior window caulk located on the exterior of the 2032 space.
- 600 SF black mastic on the wood paneling in the 2032 space.

Any materials uncovered during any renovation or demolition activities that are not addressed in this inspection report, or presumed asbestos containing materials (PACM), must be sampled by an accredited asbestos inspector prior to any disturbance, or they must be treated as ACM.

Negative Materials (No Asbestos Detected)

Results of the bulk sampling indicated the following sampled materials contained no detectable levels of asbestos, based on the Point Count PLM method:

Materials	Material Location	Quanity
Drywall/Joint Compound	Spaces 2024 and 2028	3,000 SF

A sample location diagram is included as Appendix A.

XRF Results

Date	Test #	Component	Sample Space	Unit type	Mode	Pb	Pb +/-
10/6/2022 11:42	916	Wall	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:46	917	Wall	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:47	918	Wall	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:48	919	Wall	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:50	920	Window	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:51	921	Jamb	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:52	922	Wall	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:53	923	Sill	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:54	924	Wall	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:55	925	Wall	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:56	926	Wall	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:56	927	Wall	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:58	928	Window	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:59	929	Jamb	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:00	930	Wall	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:01	931	Sill	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:01	932	Wall	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:03	933	Jamb	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:05	934	Door	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:06	935	Door	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:07	936	Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:08	937	Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:09	938	Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:11	939	Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:11	940	Window	2028	mg/cm2	Lead Paint	ND	< 0.1

10/6/2022 12:11	941	Jamb	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:12	942	Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:12	943	Sill	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:13	944	Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:13	945	Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:13	946	Jamb	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:14	947	Door	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:14	948	Door	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:19	949	Door	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:25	950	Sill	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:26	951	Exterior Column	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:26	952	Exterior Overhang Ceiling	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:27	953	Restroom Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:28	954	Restroom Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:30	955	Exterior Column	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:31	956	Restroom Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:33	957	Restroom Wall	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:33	958	Exterior Overhang Ceiling	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:33	959	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:34	960	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:35	961	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:37	962	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:38	963	Window	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:38	964	Jamb	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:39	965	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:39	966	Sill	2032	mg/cm2	Lead Paint	ND	< 0.1

10/6/2022 12:41	967	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:41	968	Restroom Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:41	969	Restroom Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:42	970	Restroom Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:42	971		2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:42	972	Exterior Overhang Ceiling	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:45	973		2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:47	974	Exterior Column	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:48	975		2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:51	976		2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:52	977	Exterior Overhang Ceiling	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:53	978	Exterior Column	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:54	979		2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:54	980		2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:55	981	Exterior Overhang Ceiling	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:58	982	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:59	983	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:00	984	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:02	985	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:03	986	Window	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:03	987	Jamb	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:04	988	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:04	989	Sill	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:05	990	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:07	991	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:08	992	Wall	2032	mg/cm2	Lead Paint	ND	< 0.1

10/6/2022 13:08	993	Restroom Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:10	994	Office Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:11	995	Exterior Overhang Ceiling	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:11	996	Restroom Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:12	997	Restroom Wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:13	998	Exterior Column	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:19	999	Office wall	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:21	1000	Office Wall	2032	mg/cm2	Lead Paint	ND	< 0.1

Laboratory analysis indicated that no lead was detected in any of the paint chip samples submitted for analysis.

RECOMMENDATIONS

Asbestos Containing Materials

A detailed Asbestos Work Plan is included in the appendices.

Lead Containing Paints

Testing by XRF analysis indicated that no lead was detected above the reportable limit in the paint surfaces tested. As such, the paints are not considered lead-containing materials.

DISCLAIMER

The content presented in this report is based on data collected during the site inspection and survey, review of pertinent regulations, requirements, guidelines and commonly followed industry standards, and information provided by Client, their clients, agents, and representatives.

The work has been conducted in an objective and unbiased manner and in accordance with generally accepted professional practice for this type of work. TRC believes the data and analysis to be accurate and relevant, but cannot accept responsibility for the accuracy or completeness of available documentation or possible withholding of information of other parties.

This limited asbestos and lead survey report is designed to aid the property owner, architect, construction manager, general contractor, and asbestos abatement contractor in locating asbestos containing materials and lead containing paints.

Sincerely,
TRC Environmental Corporation

A Conde

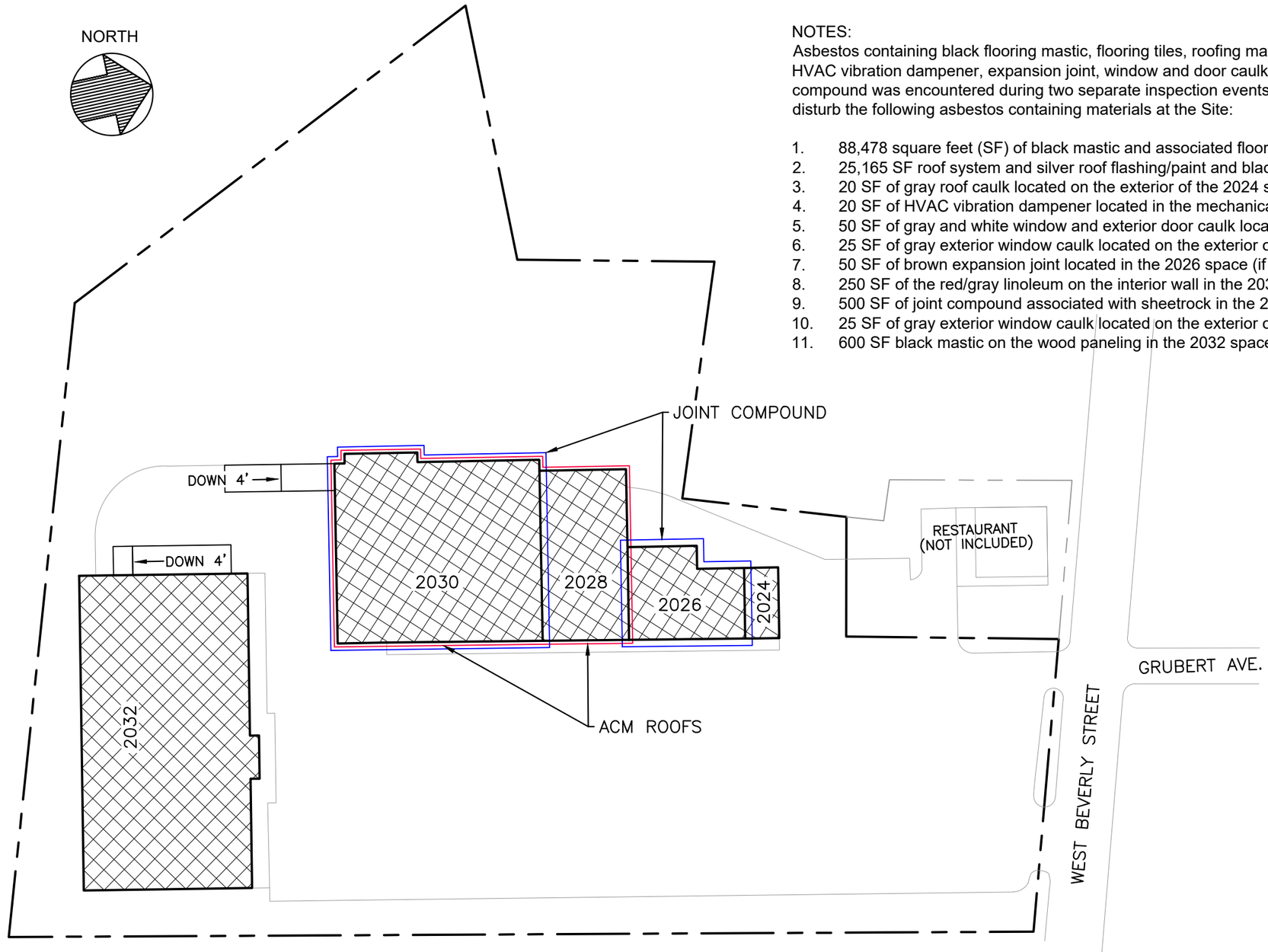
Antonio Conde
Industrial Hygienist

Andre Steuer
Senior Project Manager

Appendix A – Sample Location Diagrams

NOTES:
Asbestos containing black flooring mastic, flooring tiles, roofing materials including roof core/mastics, roof flashing and silver paint, HVAC vibration dampener, expansion joint, window and door caulk, wood paneling and cove base mastic and drywall system joint compound was encountered during two separate inspection events at the Site. It has been determined that renovation activities will disturb the following asbestos containing materials at the Site:

1. 88,478 square feet (SF) of black mastic and associated flooring located through the footprint of both Site structures.
2. 25,165 SF roof system and silver roof flashing/paint and black roof mastic located on the main roof of the 2028 and 2030 space.
3. 20 SF of gray roof caulk located on the exterior of the 2024 space.
4. 20 SF of HVAC vibration dampener located in the mechanical area of the 2030 space.
5. 50 SF of gray and white window and exterior door caulk located on the exterior of the 2032 space.
6. 25 SF of gray exterior window caulk located on the exterior of the 2026 space.
7. 50 SF of brown expansion joint located in the 2026 space (if owner designates walls for demolition)
8. 250 SF of the red/gray linoleum on the interior wall in the 2030 space.
9. 500 SF of joint compound associated with sheetrock in the 2026 and 2030 space.
10. 25 SF of gray exterior window caulk located on the exterior of the 2032 space.
11. 600 SF black mastic on the wood paneling in the 2032 space.



LEGEND

PROPERTY LINE

BLACK MASTIC
ASSOCIATED FLOORING

GRAPHIC SCALE

100 0 50 100 200

(IN FEET)
1 inch = 100 ft.

TRC ENGINEERS, INC.
2200 South Main Street
Suite A
Blacksburg, VA 24060
540-552-0444
Fax: 540-552-0291

DESIGNED	AS
DRAWN	DLD
CHECKED	AS
DATE	11/28/2022

SPCC
CHESTNUT HILL SHOPPING CENTER
CITY OF STAUNTON, VIRGINIA

SCALE: 1"=100'

PLAN NO. 018244

FIGURE
1

C:\Users\DDalton\OneDrive - TRC\Documents\CHESTNUT HILL SC.dwg Dec 01, 2022 1:28pm

Appendix B – Asbestos Workplan

Asbestos Abatement Workplan

Project Name: Chestnut Hills Plaza
2024,2026,2028,2030,2032 West Beverly Street,
Staunton, VA 22202
Date: 11/8/2022

Project Information

Asbestos containing black flooring mastic, flooring tiles, roofing materials including roof core/mastics, roof flashing and silver paint, HVAC vibration dampener, expansion joint, window and door caulk, wood paneling and cove base mastic and drywall system joint compound was encountered during two separate inspection events at the Site. It has been determined that renovation activities will disturb the following asbestos containing materials at the Site:

1. 88,478 square feet (SF) of black mastic and associated flooring located through the footprint of both Site structures.
2. 25,165 SF roof system and silver roof flashing/paint and black roof mastic located on the main roof of the 2028 and 2030 space.
3. 20 SF of gray roof caulk located on the exterior of the 2024 space.
4. 20 SF of HVAC vibration dampener located in the mechanical area of the 2030 space.
5. 50 SF of gray and white window and exterior door caulk located on the exterior of the 2032 space.
6. 25 SF of gray exterior window caulk located on the exterior of the 2026 space.
7. 50 SF of brown expansion joint located in the 2026 space (if owner designates walls for demolition)
8. 250 SF of the red/gray linoleum on the interior wall in the 2030 space.
9. 500 SF of joint compound associated with sheetrock in the 2026 and 2030 space.
10. 25 SF of gray exterior window caulk located on the exterior of the 2032 space.
11. 600 SF black mastic on the wood paneling in the 2032 space.

Scope of work is to remove the materials listed above; any non-containing asbestos materials may be disposed of as non-asbestos materials if the materials are not adhered to the black mastic that is continuous throughout the Site.

Abatement contractor to verify quantities and field conditions prior to compilation of their proposal. Contractor accepts existing field conditions as part of their proposal. Abatement contractor is responsible for removal of all materials described above in accordance with all federal, state, and local guidelines. Contractor will acquire any necessary notifications (i.e., EPA and VA 10-day notification) and any necessary permits (e.g., building permits) for the work.

Project Requirements

The following Containment and or Enclosure Type(s) shall be required:

- The above listed interior materials will be removed following Class I Containment requirements (Full Containment). The perimeter spaces of the work area consist of mostly windows and doors. The poly sheeting used to construct the containment along the perimeter of the work area shall contain enough opacity to obstruct sight lines from other areas of the building and from other nearby buildings to the work area. Abatement contractor to provide work plan prior to the issuance of the contract. Details must

include containment construction, decontamination unit, waste load out, negative air calculations, etc.., as warranted.

Preparations

- **Abatement contractor shall maintain negative pressure within all containments: Greater than -0.02 in/H_2O and documented by using a chart recording manometer that operates continuously throughout the project**
- Owner will provide access to electricity and water – contractor is responsible for the installation of a temporary electric panel.
- Provide Health and Safety Plan
- Modification of the abatement/demo notification will be the responsibility of abatement contractor; abatement contractor will be responsible for ensuring asbestos abatement notification(s) is properly filed with required agencies

Dates and Times

- Project Dates: Abatement to start date TBD
- Hours of Work: TBD but delineated on any abatement notification.

Waste Disposal

The following additional requirements for waste disposal shall apply:

- All asbestos-containing material (ACM) will be disposed of at a landfill that is pre-approved by TRC to accept the ACM manifested waste whether friable or non-friable.
- Contractor shall place a lockable waste container at the Site. Any waste containers used to hold asbestos wastes must be lined with 6 mil poly sheeting, be fully enclosed, and be locked when not in use
- Contractor shall include the waste container type and site location within the pre-project abatement plan. dumpster drop off will need to be included with the abatement contractor's work plan.

Facility Use

The abatement contractor has use of the following:

- Washrooms: Abatement contractor required to clean restrooms daily . In the event that the restrooms are not available, abatement contractor will be required to supply adequate facilities for their work force
- Parking: One spot is available in the loading dock area. Additional paid parking is available in the parking garage.
- Security: Abatement contractor will be responsible for the security of their equipment while scope of work is being performed.
- Abatement contractor has no salvage rights to any of the materials removed from the property

Work By Others

The abatement contractor is responsible for the following:

- Owner electrician for temporary power hook-up, lighting? No, hookup to be performed by electrician approved by building owner, equipment provided by contractor.
- Lock-out Tag-out? No, performed by building approved electrician
- Temporary light? Yes, provided by general contractor.
- Plumber for temporary water hook-up No
- Removal of glass/panel for negative air exhaust? N/A
- Re-installation of glass? N/A
- Installation of negative air that exhausts to the outdoors? Yes
- Non-hazardous demolition Yes

Other

The abatement contractor shall provide one (1) copy of submittals in electronic form.

1. Pre-submittals include insurance certificate, W form, landfill information, and abatement contractor certification or registration. Insurance requirements attached to form.
2. Close-out documentation – 30 days after completion of project, abatement contractor to provide list of workers and supervisors with expiration dates and fit test completion dates, daily personal monitoring results, containment entry/exit logs/daily field logs, manifest/disposal receipts, permit modifications, etc.

Ambient Air Sampling

The Monitoring Consultant to collect the following ambient air samples:

- Number of outside work area samples: at waste load out and entry to containment
- Type of analysis: Phase Contract Microscopy (PCM)
- Acceptable level(s): <0.01 fibers per cubic centimeter (f/cc) of air

Clearance Air Sampling

The Monitoring Consultant shall collect the following clearance air samples:

- Number of samples per work area: five (5)
- Type of analysis: PCM
- Acceptable clearance level(s): <0.01 f/cc

Attachments

The abatement contractor is responsible for complying with the following instructions or attachments issued by the Monitoring Consultant:

- Site Visit
- Insurance requirements

The undersigned hereby declares that he/she has fully investigated the existing conditions at the site and has examined the contract documents and addenda for the above referenced project. The abatement contractor acknowledges that it is in receipt of the building owner/operator representative's current General Conditions and Supplementary Conditions, which are incorporated by reference herein and are included as part of the project contract documents.

Name: _____

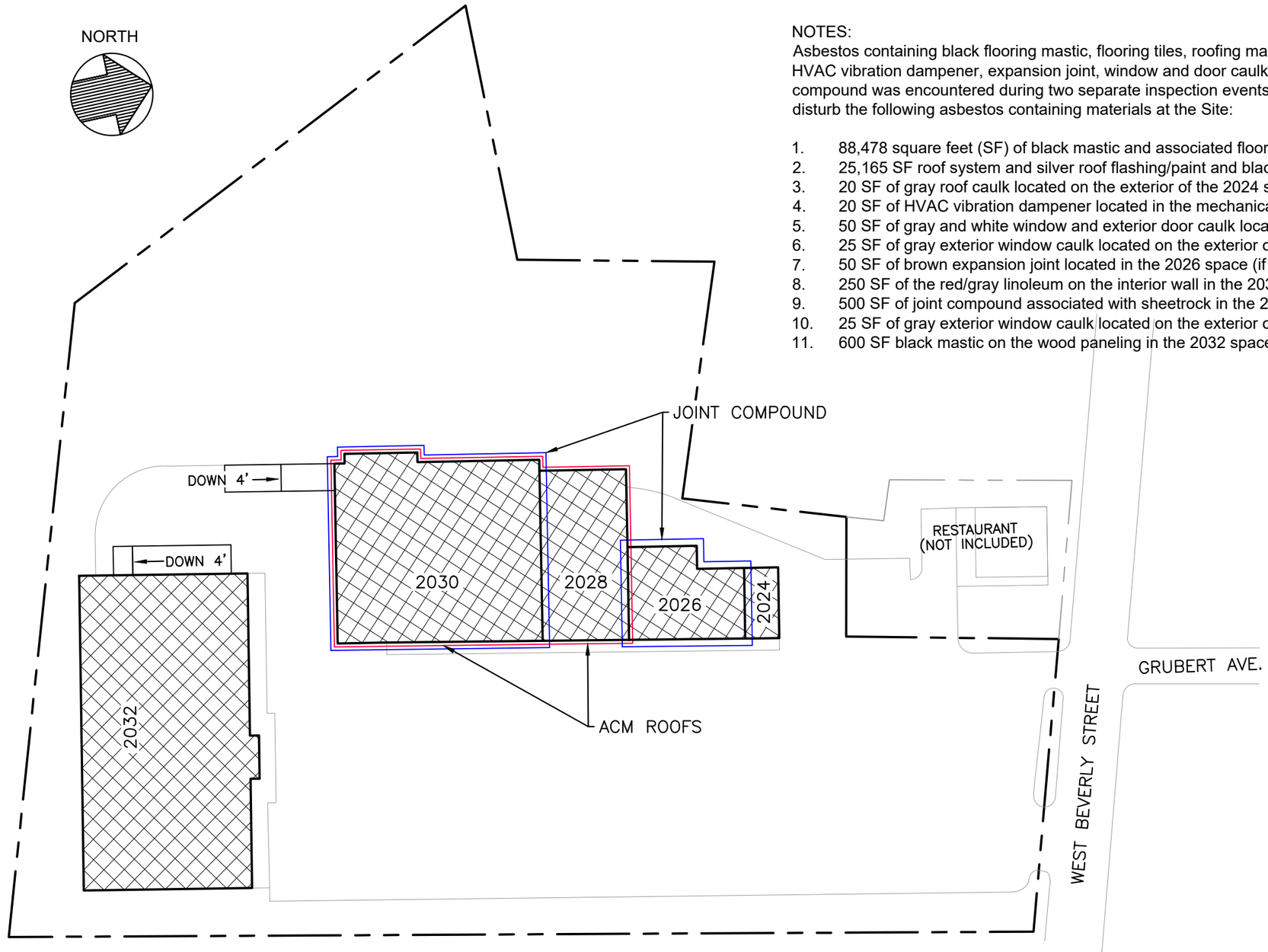
Title: _____

Signature: _____

Date: _____

NOTES:
Asbestos containing black flooring mastic, flooring tiles, roofing materials including roof core/mastics, roof flashing and silver paint, HVAC vibration dampener, expansion joint, window and door caulk, wood paneling and cove base mastic and drywall system joint compound was encountered during two separate inspection events at the Site. It has been determined that renovation activities will disturb the following asbestos containing materials at the Site:

1. 88,478 square feet (SF) of black mastic and associated flooring located through the footprint of both Site structures.
2. 25,165 SF roof system and silver roof flashing/paint and black roof mastic located on the main roof of the 2028 and 2030 space.
3. 20 SF of gray roof caulk located on the exterior of the 2024 space.
4. 20 SF of HVAC vibration dampener located in the mechanical area of the 2030 space.
5. 50 SF of gray and white window and exterior door caulk located on the exterior of the 2032 space.
6. 25 SF of gray exterior window caulk located on the exterior of the 2026 space.
7. 50 SF of brown expansion joint located in the 2026 space (if owner designates walls for demolition)
8. 250 SF of the red/gray linoleum on the interior wall in the 2030 space.
9. 500 SF of joint compound associated with sheetrock in the 2026 and 2030 space.
10. 25 SF of gray exterior window caulk located on the exterior of the 2032 space.
11. 600 SF black mastic on the wood paneling in the 2032 space.



LEGEND

PROPERTY LINE

BLACK MASTIC
ASSOCIATED FLOORING

GRAPHIC SCALE

100 0 50 100 200

(IN FEET)
1 inch = 100 ft.

TRC ENGINEERS, INC.
2200 South Main Street
Suite A
Blacksburg, VA 24060
540-552-0444
Fax: 540-552-0291

DESIGNED	AS
DRAWN	DLD
CHECKED	AS
DATE	11/28/2022

SPCC
CHESTNUT HILL SHOPPING CENTER
CITY OF STAUNTON, VIRGINIA

SCALE: 1"=100'

PLAN NO. 018244

FIGURE
1

C:\Users\DDalton\OneDrive - TRC\Documents\CHESTNUT HILL SC.dwg Dec 01, 2022 1:28pm

Appendix C – Laboratory Results and Chain of Custody

Industrial Hygiene Laboratory
21 Griffin Road North
Windsor, CT 06095
(860) 298-6308

BULK ASBESTOS ANALYSIS REPORT

CLIENT: City of Staunton- VA

Lab Log #: 0060468
Project #: 018244.0000.0000
Date Received: 10/17/2022
Date Analyzed: 10/19/2022

Site: Unknown

POLARIZED LIGHT MICROSCOPY by EPA 600/R-93/116

Sample No.	Sample Location	Homogeneous Material Description	Other Matrix Materials	Asbestos %	Asbestos Type
2024 2A ■	2024	White joint compound	- - -	<0.25%	Chrysotile
2024 2B ■	2024	White joint compound	- - -	<0.25%	Chrysotile
2024 2C ■	2024	White joint compound	- - -	0.25%	Chrysotile
2028 2E ■	2028	White joint compound	- - -	<0.25%	Chrysotile
2028 2F ■	2028	White joint compound	- - -	<0.25%	Chrysotile

■ Analyzed by 400 Point Count Method
ND- No asbestos was detected by 400 Point Count Method
<0.25-Trace concentrations of asbestos are concentrations that are less than 0.25% including samples that contain zero asbestos points out of 400 nonempty points, but did contain asbestos positively identified by PLM. This is the reporting limit.

ND - asbestos was not detected
Trace - asbestos was observed at level of 1% or less - This is the reporting limit
NA/PS - Not Analyzed / Positive Stop
SNA - Sample Not Analyzed- See Chain of Custody for details
Notes: Asbestos-Containing Material (ACM) is any material containing more than 1% asbestos

Note: Polarized-light microscopy is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. In those cases, EPA recommends, and certain states (e.g. NY) require, that negative results be confirmed by quantitative transmission electron microscopy.

The Laboratory at TRC follows the EPA's Interim Method for the Determination of Asbestos in Bulk Insulation 1982 (EPA 600/M4-82-020) Bulk Analysis Code 18/A01 and the EPA recommended Method for the Determination of Asbestos in Bulk Building Materials July 1993, R.L. Perkins and B.W. Harvey, (EPA/600/R-93/116) Bulk Analysis Code 18/A03, which utilize polarized light microscopy (PLM). Our analysts have completed an accredited course in asbestos identification. TRC's Laboratory is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP), for Bulk Asbestos Fiber Analysis, NVLAP Code 18/A01, effective through June 30, 2023. TRC is accredited by the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC in the Industrial Hygiene Program (IHLAP) for PLM effective through October 1, 2024. Asbestos content is determined by visual estimate unless otherwise indicated. Quality Control is performed in-house on at least 10% of samples and QC data related to the samples is available upon written request from client.

This report shall not be reproduced, except in full, without the written approval of TRC. This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government. This report relates only to the items tested, as received by the laboratory.

Analyzed by: Kathleen Williamson, Laboratory Manager

Reviewed by: Joel Corso, Approved Signatory

Date Issued 10/19/2022

TRC

21 GRIFFIN ROAD NORTH
WINDSOR, CONNECTICUT 06095
TELEPHONE (860) 298-9692
FAX (860) 298-6380

Edition: October 2009
Supersede Previous Edition

ASBESTOS BULK SAMPLING CHAIN OF CUSTODY

LAB ID #. 604468

PROJECT NUMBER	PROJECT NAME	PARAMETERS	TURNAROUND TIME
018244	City of Stanton, VA		PLM: [ ] 8hr [ ] 24hr [ ] 48hr [ ] 3day TEM: [ ] 24hr [ ] 48hr [X] 3day [ ] 5day
SIGNATURE: A. Steuer	INSPECTOR: A. Steuer		

FIELD SAMPLE NUMBER	DATE	TIME	TYPE: COMP	TYPE: GRAB	SAMPLE LOCATION	PLM EPA 600/R93/116 (POSITIVE STOP)	PLM EPA 600/R93/116 (w/ gravimetric reduction) (POSITIVE STOP)	ANALYZE BY LAYER	POINT COUNT (IF >1% & <10%)	TEM NY NOB 198.4 (IF PLM SERIES NEG)	MATERIAL
2024 2A	10/15/2022				2024				X		Joint Compound
2024 2B	10/15/2022				2024				X		Joint Compound
2024 2C	10/15/2022				2024				X		Joint Compound
20282E	10/15/2022				2028				X		Joint Compound
20282F	10/15/2022				2028				X		Joint Compound
									X		Joint Compound

Relinquished by: (Signature)	Date:	Received by: (Signature)	Relinquished by: (Signature)	Date:	Received by: (Signature)
A. Steuer	10/17/2022	10/17/22			
(Printed) Andre Steuer	Time:	(Printed) 1130 Williamson	(Printed)	Time:	(Printed)

Remarks: these were less than 1% previously by Eurofins we need a positive or negative.

Condition of Samples:
Acceptable: Yes ✓ No
Comments:

XRF Results for lead based paint - Cheasnut Hills Stantun, VA - No Lead

Date	Test #	Sample ID	Unit type	Mode	Pb	Pb +/-
10/6/2022 11:42	916		mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:46	917	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:47	918	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:48	919	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:50	920	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:51	921	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:52	922	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:53	923	2024	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:54	924	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:55	925	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:56	926	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:56	927	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:58	928	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 11:59	929	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:00	930	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:01	931	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:01	932	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:03	933	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:05	934	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:06	935	2026	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:07	936	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:08	937	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:09	938	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:11	939	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:11	940	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:11	941	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:12	942	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:12	943	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:13	944	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:13	945	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:13	946	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:14	947	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:14	948	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:19	949	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:25	950	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:26	951	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:26	952	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:27	953	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:28	954	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:30	955	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:31	956	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:33	957	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:33	958	2028	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:33	959	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:34	960	2032	mg/cm2	Lead Paint	ND	< 0.1

10/6/2022 12:35	961	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:37	962	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:38	963	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:38	964	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:39	965	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:39	966	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:41	967	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:41	968	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:41	969	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:42	970	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:42	971	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:42	972	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:45	973	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:47	974	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:48	975	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:51	976	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:52	977	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:53	978	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:54	979	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:54	980	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:55	981	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:58	982	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 12:59	983	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:00	984	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:02	985	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:03	986	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:03	987	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:04	988	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:04	989	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:05	990	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:07	991	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:08	992	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:08	993	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:10	994	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:11	995	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:11	996	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:12	997	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:13	998	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:19	999	2032	mg/cm2	Lead Paint	ND	< 0.1
10/6/2022 13:21	1000	2032	mg/cm2	Lead Paint	ND	< 0.1

Appendix D – Field Documentation/Previous Reports

PATRICK DIFLORIO
President
patrickd@ntelos.net
Phone: (540) 294-8930

DIVERSIFIED ENVIRONMENTAL SERVICES

Federal ID Number: 47-2475380

P. O. Box 1365 *(zip code 24402)*
1219-B Stoneburner Street
Staunton, Virginia 24401

Asbestos Inspection Survey

Chestnut Hills Plaza
Vacant Commercial Spaces
2024, 2026, 2028, 2030, and 2032 West Beverley Street
Staunton, Virginia

Prepared by:

Diversified Environmental Services
PO Box 1365 (24402)
1219 B Stoneburner Street
Staunton, Virginia 24401
Patrick A. DiFlorio, President

DES Project #2173

September 2021

DIVERSIFIED ENVIRONMENTAL SERVICES



Patrick A. DiFlorio, President

PATRICK DIFLORIO
President
patrickd@ntelos.net
Phone: (540) 294-8930

DIVERSIFIED ENVIRONMENTAL SERVICES

Federal ID Number: 47-2475380

P. O. Box 1365 *(zip code 24402)*
1219-B Stoneburner Street
Staunton, Virginia 24401

September 21, 2021

MMR Construction, LLC
Rocco Cionni
4030 Sunset Blvd.
Steubenville, Ohio 43952

Reference: Asbestos Inspection Survey
Parcels – Vacant Commercial Space
2024, 2026, 2028, 2030, and 2032 W Beverley St
Harrisonburg, Virginia

Gentlemen,

On September 6 through the 13th, 2021, Diversified Environmental Services (DES) collected and placed under chain of custody, eighty-nine (89) bulk samples of suspect asbestos containing material from the above referenced locations. The samples were sent to Eurofins / Carolina Environmental Laboratories in Cary, North Carolina for PLM analysis. The bulk samples may have been further separated into additional layers and then analyzed via Polarized Light Microscopy using the EPA Interim Method (EPA 600/M4-82-020 per 40 CFR 763, subpart F, App. A). Additionally, due to positive analysis on multiple samples of the same homogeneous materials, some samples were not analyzed under a “positive stop” protocol. A total of seventy-four (74) samples were analyzed.

The Structures

The present use of the spaces is: Unoccupied / Commercial

The parcels are one-story brick CMU block buildings with brick veneer facades. Exterior walls are composed of brick and CMU block. The structures rest on concrete foundation and concrete slabs. Interior walls consist of wood framing with either painted gypsum wallboard or wood panel finishes. Floor finishes include carpet, sheet goods, and floor tile. The ceilings are suspended grid systems with various 2’x4’ ceiling tile designs. Store front windows are anodized aluminum in metal frames. Most roofs are a flat membrane design on a metal deck. There are some locations where built-up roofing exists.

The Inspection

This inspection, at a minimum, was performed in strict accordance with EPA 40 CFR 61 Part M - National Emission Standards for Hazardous Air Pollutants (NESHAP), EPA 40 CFR Part 763, Subpart 5 - Asbestos Hazard Emergency Response Act (AHERA) and Occupational Safety and Health Administration 29 CFR 1910.1101, as they pertain.

Suspect materials were categorized into homogenous groups based on similar like composition, color, texture, etc.

The materials were further distinguished by classifying them for friability.

Friable Asbestos Containing Materials (ACM) - Material containing more than 1% asbestos which has been applied to ceilings, walls, structural members, piping, duct work or any other part of a building, and which, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure.

Suspect materials within the areas of demolition include:

Window Caulk	Expansion Joints	Baseboard / Mastic	HVAC Vibration Dampener	Floor tile / Mastic	Roof Mastic
Sheet Goods	Joint Compound	Skim Coats	Roof Field Core	Door Caulk	Ceiling tile

Subsequent analysis of these samples determined that the following materials collected were determined to be Asbestos Containing Building Materials (ACBM), >1% asbestos.

Sample legend – (#2173-* -*-*) DES Project #- Parcel Address#- Homogeneous Area- Sample #

AHERA Rating-

#1 – Damaged or significantly damaged Thermal System Insulation (TSI).
#2- Damaged friable surfacing ACM.
#3- Significantly damaged friable surfacing ACM.
#4- Damaged or significantly damaged friable miscellaneous ACM.
#5- ACBM with potential for damage.
#6- ACBM with potential for significant damage.
#7- Any remaining friable ACBM or friable suspected ACBM.

2024

Approximately 1,500 Square Feet

Sample	Description	Category	Friability	Rating	Condition
#2173-2024-1-2 #2173-2024-1-3	*Joint Compound (Trace <1%)	Miscellaneous	Friable	#4	Good
#2173-2024-3-1 #2173-2024-3-2 #2173-2024-3-3	Green 12x12 Floor Tile and Mastic	Miscellaneous	Non-Friable	#6	Good
#2173-2024-4-1B	**Black Mastic under Tan 12x12	Miscellaneous	Non-Friable	#6	Good
#2173-2024-10-1	Old Roof Mastic (Gray)	Miscellaneous	Non-Friable	#6	Good

***Trace Materials-**

<1% Asbestos (Less than 1% - Trace)

Trace materials are not regulated by federal EPA NESHAP. However, OSHA regulates any amount of asbestos regardless of percentages. Therefore, the following OSHA interpretations were considered for this inspection process:

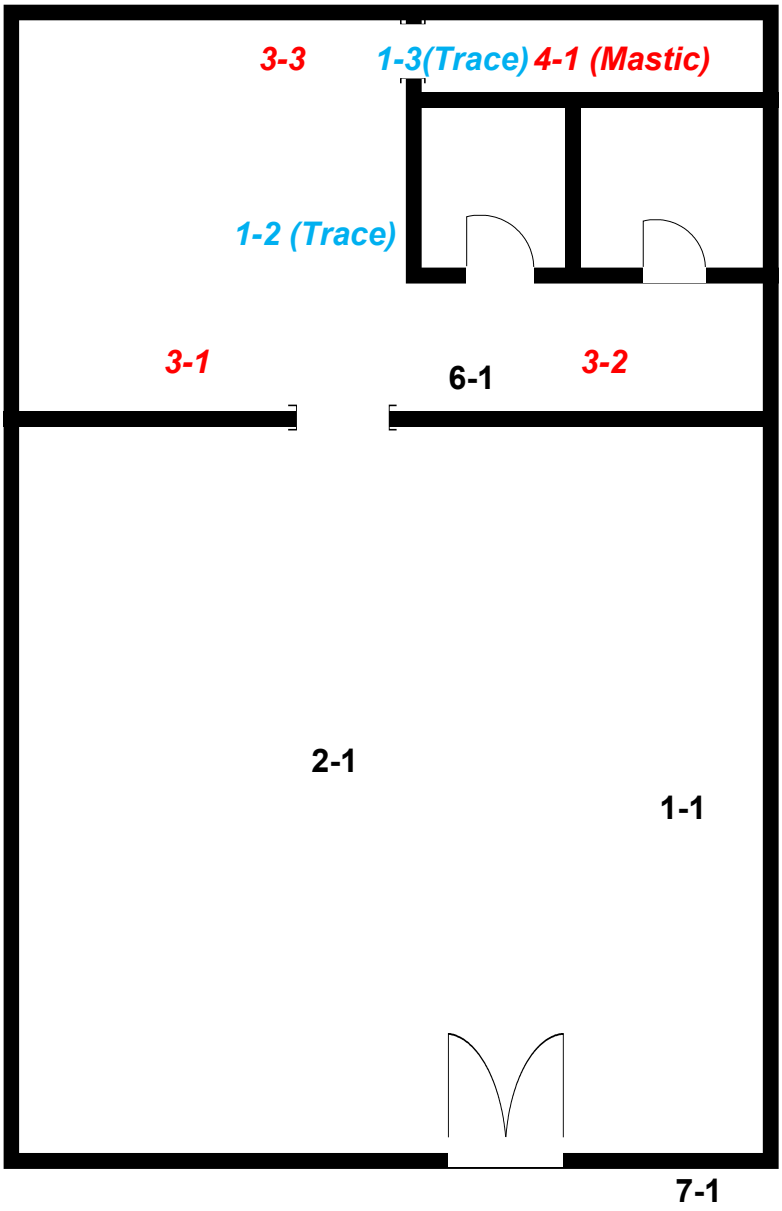
29 CFR 1926.1101(g)(1)(ii) requires:

"Wet methods, or wetting agents, to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup, except where employers demonstrate that the use of wet methods is infeasible due to for example, the creation of electrical hazards, equipment malfunction, and, in roofing, except as provide in paragraph (g)(8)(ii) of this section;"

29 CFR 1926.1101(g)(1)(iii) requires:

"Prompt clean-up and disposal of wastes and debris contaminated with asbestos in leak-tight containers except in roofing operations, where the procedures specified in paragraph (g)(8)(ii) of this section apply."

****Mastic** that has tested "positive" for asbestos that remains adhered to the associated non-asbestos floor tile, renders that floor tile "positive".



2024 West Beverley Street

Not To Scale

Samples Taken From Roof

8-1

10-1

9-1

11-1 (Awning)

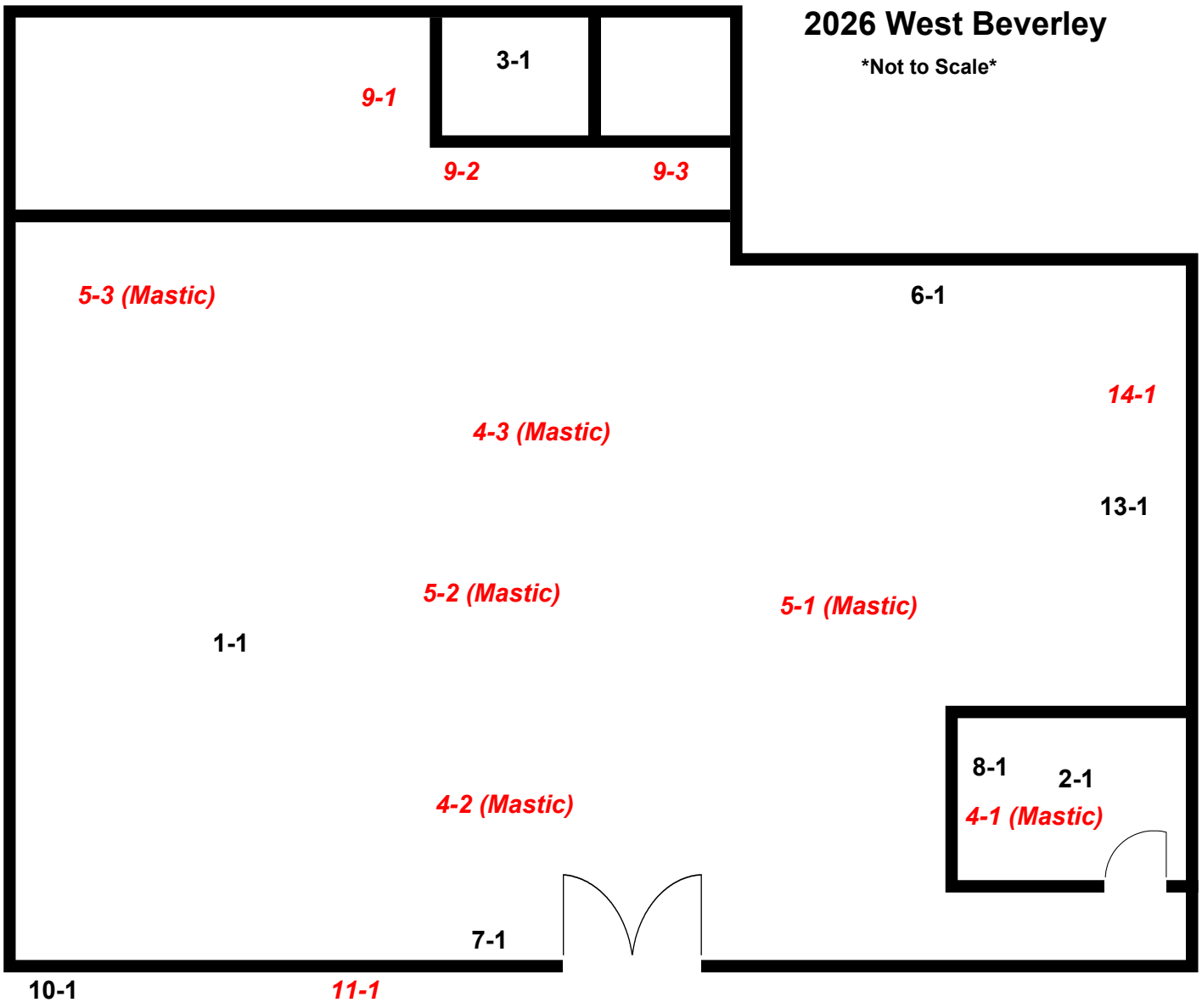
2026

Approximately 6,300 Square Feet

Sample	Description	Category	Friability	Rating	Condition
#2173-2026-4-1B #2173-2026-4-2B #2173-2026-4-3B	Black Mastic under Gray 12x12	Miscellaneous	Non-Friable	#6	Good
#2173-2026-5-1B #2173-2026-5-2B #2173-2026-5-3B	**Black Mastic under Beige 12x12	Miscellaneous	Non-Friable	#6	Good
#2173-2026-9-1 #2173-2026-9-2 #2173-2026-9-3	Joint Compound	Miscellaneous	Friable	#4	Good
#2173-2026-11-1	Window Caulk	Miscellaneous	Non-Friable	#6	Good
#2173-2026-14-1	Interior Expansion Joint	Miscellaneous	Non-Friable	#6	Good

2026 West Beverley

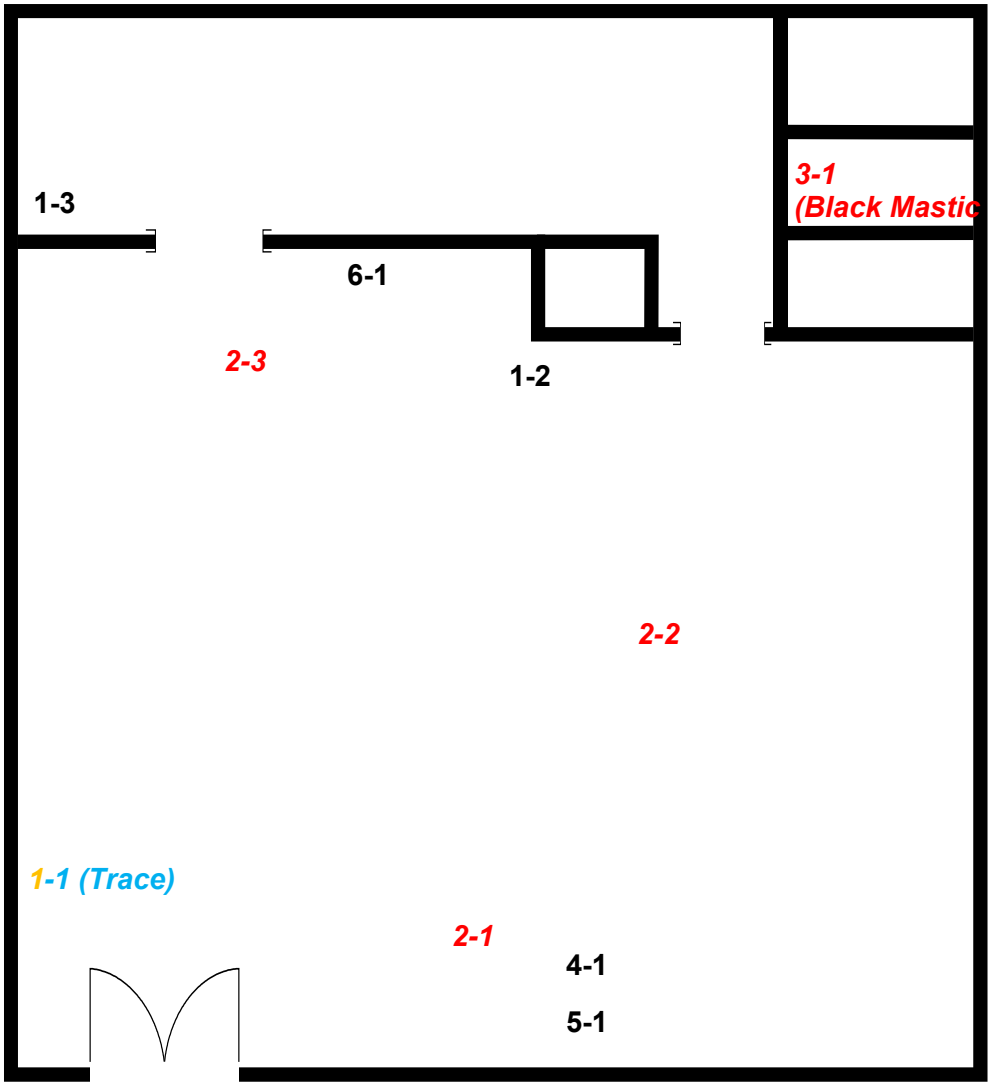
Not to Scale



2028

Approximately 11,250 Square Feet

#2173-2028-1-1	*Joint Compound (Trace <1%)	Miscellaneous	Friable	#4	Good
#2173-2028-2-1 #2173-2028-2-2 #2173-2028-2-3	Tan 12x12 Floor Tile and Black Mastic	Miscellaneous	Non-Friable	#6	Good
#2173-2028-3-1B	**Black Mastic under Gray Linoleum	Miscellaneous	Non-Friable	#6	Good
#2173-2028-9-1	Roof Field Core (Built Up Roof)	Miscellaneous	Non-Friable	#6	Good



2028 West Beverley

Not To Scale

Samples Taken From Roof

7-1 9-1

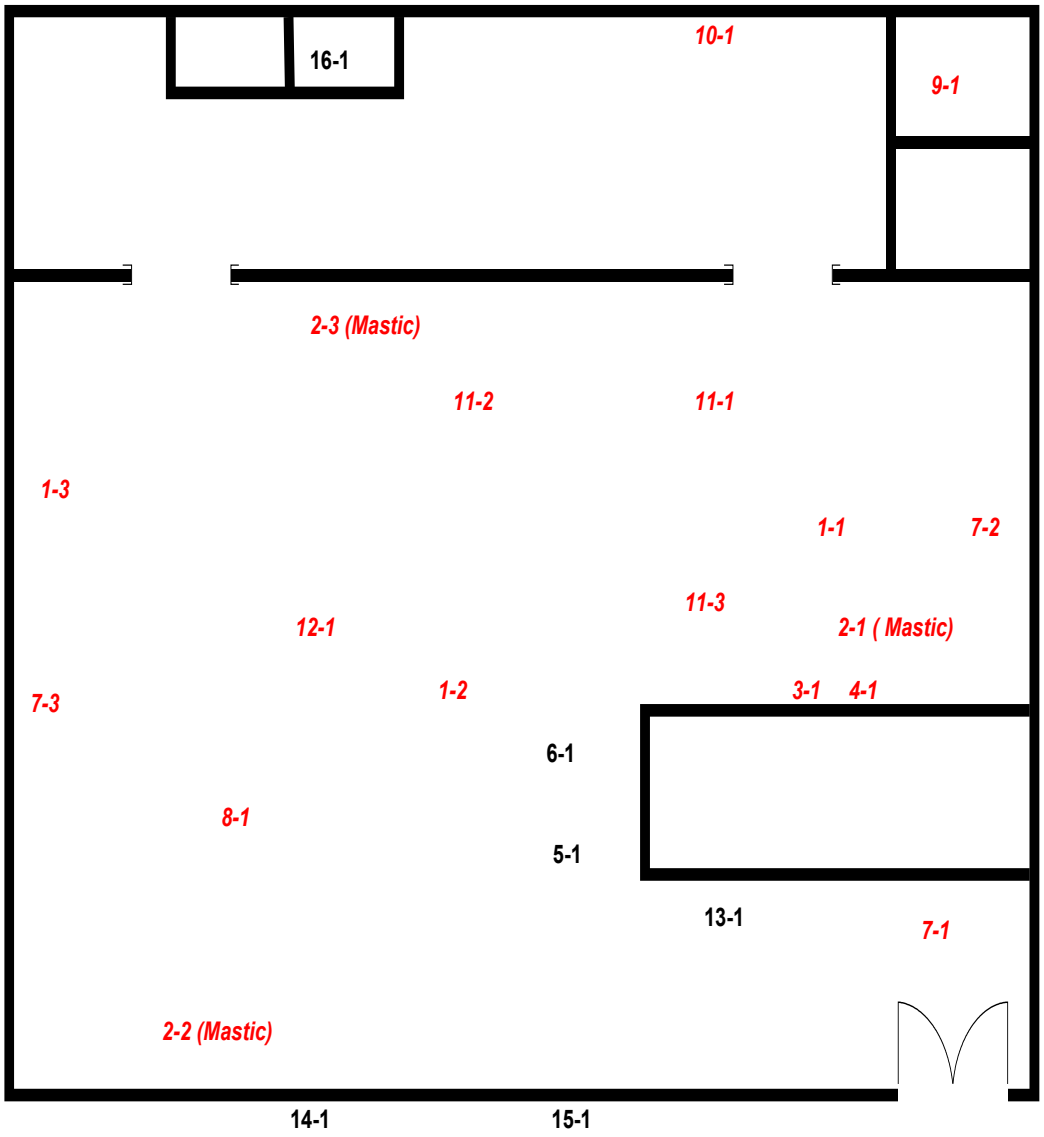
8-1

2030

Approximately 27,000 Square Feet

#2173-2030-1-1 #2173-2030-1-2 #2173-2030-1-3	Beige 12x12 Floor Tile and Black Mastic	Miscellaneous	Non-Friable	#6	Good
#2173-2030-2-1B #2173-2030-2-2B #2173-2030-2-3B	**Black Mastic under "Brick" 9x9	Miscellaneous	Non-Friable	#6	Good
#2173-2030-3-1	Red Wall Linoleum (Top Layer)	Miscellaneous	Non-Friable	#6	Good
#2173-2030-4-1	Red/Gray Wall Linoleum and yellow Mastic (Bottom Layer)	Miscellaneous	Non-Friable	#6	Good
#2173-2030-7-1 #2173-2030-7-2 #2173-2030-7-3	Joint Compound	Miscellaneous	Friable	#4	Good
#2173-2030-8-1	Green 12x12 Floor Tile and Black Mastic	Miscellaneous	Non-Friable	#6	Good
#2173-2030-9-1	White 12x12 Floor Tile and Black Mastic	Miscellaneous	Non-Friable	#6	Good
#2173-2030-10-1	HVAC Vibration Dampener	Miscellaneous	Friable	#4	Good
#2173-2030-11-1 #2173-2030-11-2 #2173-2030-11-3	"Brick" 12x12 Floor Tile and Black Mastic	Miscellaneous	Non-Friable	#6	Good
#2173-2030-12-1	Black 12x12 Floor Tile and Black Mastic	Miscellaneous	Non-Friable	#6	Good
#2173-2030-17-1	HVAC Mezzanine Roof Core (Felt Paper)	Miscellaneous	Non-Friable	#6	Good

#2173-2030-18-1	Roof Core (Felt Paper)	Miscellaneous	Non-Friable	#6	Good
#2173-2030-19-1	Roof Flashing and associated Silver Paint	Miscellaneous	Non-Friable	#6	Good
#2173-2030-20-1	Roof Mastic	Miscellaneous	Non-Friable	#6	Good



2030 West Beverley Street

Not To Scale

Samples Taken From Roof

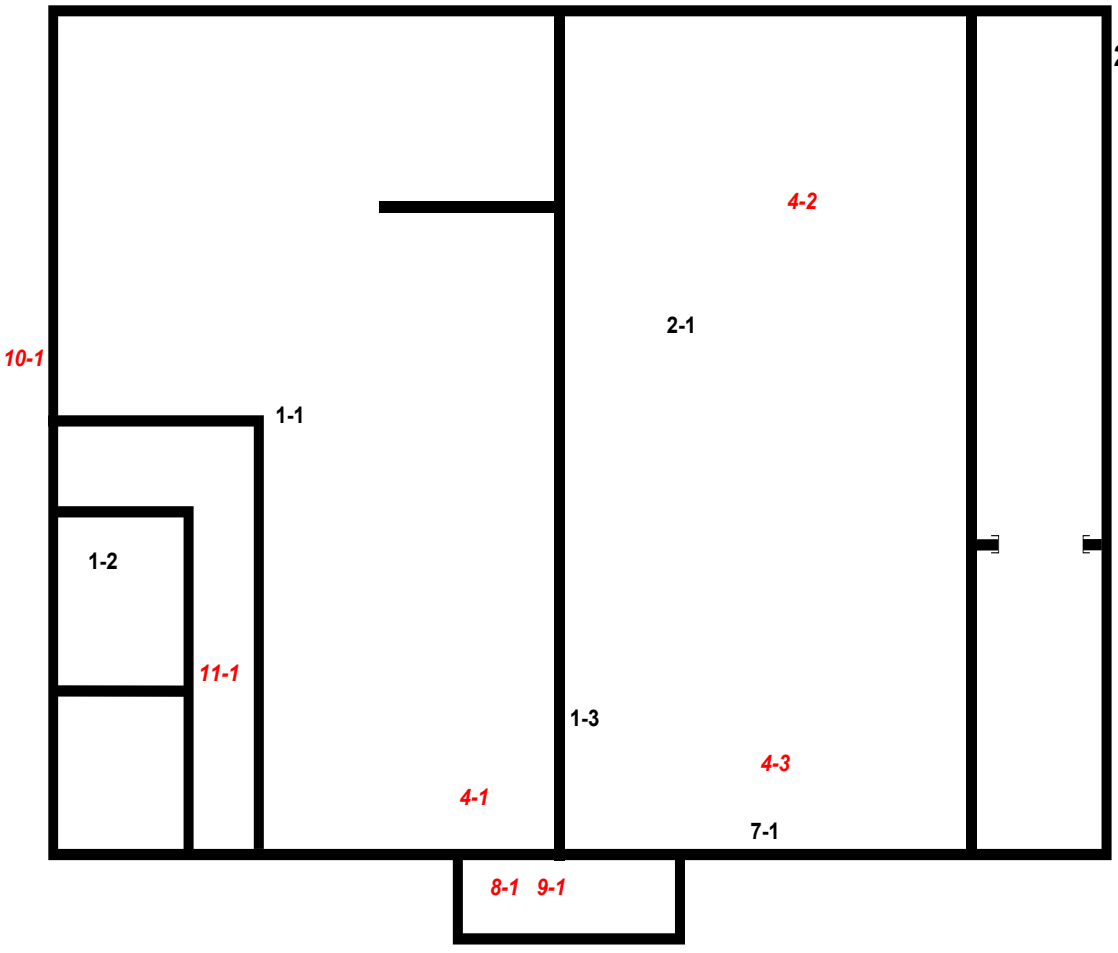
17-1 18-1

19-1 20-1

2032

Approximately 44,000 Square Feet

#2173-2032-4-1 #2173-2032-4-2 #2173-2032-4-3	Off-White 12x12 Floor Tile and Black Mastic	Miscellaneous	Non-Friable	#6	Good
#2173-2032-8-1	Window Caulk	Miscellaneous	Non-Friable	#6	Good
#2173-2032-9-1	Door Caulk	Miscellaneous	Non-Friable	#6	Good
#2173-2032-10-1	Exterior Expansion Joint	Miscellaneous	Non-Friable	#6	Good
#2173-2032-11-1	Wood Paneling Mastic	Miscellaneous	Non-Friable	#6	Good



2032 West Beverly Street

Not To Scale

Samples Taken From Roof

12-1 12-2

Any activities that involve the cutting, sanding, tearing, or otherwise disturbing the above listed materials should be preceded by an abatement of the affected areas by an EPA-accredited, State-licensed asbestos contractor.

This inspection only identifies accessible asbestos containing materials. Materials located within chases, walls, above hard cast plaster ceilings, or otherwise considered inaccessible, either by physical barrier or for proprietary reasons, were not sampled and should be considered as "presumed asbestos containing materials (PACM), until future testing is made available.

Included in this report is the individual sample analysis of the materials collected.

If we can further assist you, please contact our office at your convenience.

Best regards,
DIVERSIFIED ENVIRONMENTAL SERVICES



Patrick DiFlorio
President

eurofins | CEI

Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Chestnut Hills Plaza, 2173 **LAB CODE: B216567**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
#2173-2024-1-1		B108747	White	Joint Compound	None Detected
#2173-2024-1-2		B108748	White	Joint Compound	Chrysotile <1%
#2173-2024-1-3		B108749	White	Joint Compound	Chrysotile <1%
#2173-2024-2-1		B108750	White	Ceiling Tile	None Detected
#2173-2024-3-1		B108751A	Green	Floor Tile	Chrysotile 2%
		B108751B	Black	Mastic	Chrysotile 3%
#2173-2024-3-2		B108752A		Sample Not Analyzed per COC	
		B108752B		Sample Not Analyzed per COC	
#2173-2024-3-3		B108753A		Sample Not Analyzed per COC	
		B108753B		Sample Not Analyzed per COC	
#2173-2024-4-1		B108754A	Tan	Floor Tile	None Detected
		B108754B	Black	Mastic	Chrysotile 3%
#2173-2024-6-1		B108755A	Black	Baseboard	None Detected
		B108755B	Brown	Mastic	None Detected
#2173-2024-7-1		B108756	Gray	Window Caulk	None Detected
#2173-2024-8-1	Layer 1	B108757	Black	Roof Field Core	None Detected
	Layer 2	B108757	Brown	Paper	None Detected
	Layer 3	B108757	Brown	Insulation	None Detected
#2173-2024-9-1	Layer 1	B108758	Black	Roof Drip Edge	None Detected
	Layer 2	B108758	Black	Felt Paper	None Detected
	Layer 3	B108758	Brown	Insulation	None Detected
	Layer 4	B108758	White	Membrane	None Detected
#2173-2024-10-1		B108759	Black	Old Roof Mastic	Chrysotile 5%
#2173-2024-11-1		B108760	Black	Awning Mastic	None Detected
#2173-2026-1-1		B108761	White	Ceiling Tile	None Detected
#2173-2026-2-1		B108762	White	Ceiling Tile	None Detected
#2173-2026-3-1		B108763	White	Ceiling Tile	None Detected
#2173-2026-4-1		B108764A	Gray	Floor Tile	None Detected
		B108764B	Black	Mastic	Chrysotile 2%
#2173-2026-4-2		B108765A	Gray	Floor Tile	None Detected
		B108765B		Sample Not Analyzed per COC	

eurofins | CEI

Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Chestnut Hills Plaza, 2173 **LAB CODE: B216567**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
#2173-2026-4-3		B108766A	Gray	Floor Tile	None Detected
		B108766B		Sample Not Analyzed per COC	
#2173-2026-5-1		B108767A	Gray	Floor Tile	None Detected
		B108767B	Black	Mastic	Chrysotile 2%
#2173-2026-5-2		B108768A	Gray	Floor Tile	None Detected
		B108768B		Sample Not Analyzed per COC	
#2173-2026-5-3		B108769A	Gray	Floor Tile	None Detected
		B108769B		Sample Not Analyzed per COC	
#2173-2026-6-1		B108770A	Brown	Baseboard	None Detected
		B108770B	Yellow	Mastic	None Detected
#2173-2026-7-1		B108771A	Black	Baseboard	None Detected
		B108771B	Beige	Mastic	None Detected
#2173-2026-8-1		B108772	Beige	Linoleum	None Detected
#2173-2026-9-1		B108773	White	Joint Compound	Chrysotile 2%
#2173-2026-9-2		B108774		Sample Not Analyzed per COC	
#2173-2026-9-3		B108775		Sample Not Analyzed per COC	
#2173-2026-10-1		B108776	Gray	Exterior Expansion Joint	None Detected
#2173-2026-11-1		B108777	Gray	Window Caulk	Chrysotile 5%
#2173-2026-13-1		B108778	Black	Wall Mastic	None Detected
#2173-2026-14-1		B108779	Brown	Interior Expansion Joint	Chrysotile 5%
#2173-2028-1-1		B108780	White	Joint Compound	Chrysotile <1%
#2173-2028-1-2		B108781	White	Joint Compound	None Detected
#2173-2028-1-3		B108782	White	Joint Compound	None Detected
#2173-2028-2-1	Layer 1	B108783A	Green	Mastic	None Detected
	Layer 2	B108783A	Tan	Floor Tile	Chrysotile 3%
		B108783B	Black	Mastic	Chrysotile 5%
#2173-2028-2-2		B108784		Sample Not Analyzed per COC	
#2173-2028-2-3		B108785		Sample Not Analyzed per COC	
#2173-2028-3-1		B108786A	Brown,Gray	Linoleum	None Detected
	Layer 1	B108786B	Yellow	Mastic	None Detected
	Layer 2	B108786B	Black	Mastic	Chrysotile 2%

eurofins | CEI

Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Chestnut Hills Plaza, 2173 **LAB CODE: B216567**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
#2173-2028-4-1		B108787	White,Tan	Ceiling Tile	None Detected
#2173-2028-5-1		B108788	White,Tan	Ceiling Tile	None Detected
#2173-2028-6-1		B108789A	Black	Baseboard	None Detected
		B108789B	Yellow,White	Mastic	None Detected
#2173-2028-7-1		B108790	Black,Silver	Roof Mastic	None Detected
#2173-2028-8-1		B108791	Black	Pitch Pocket	None Detected
#2173-2028-9-1	Layer 1	B108792	Black	Roof Core	None Detected
	Layer 2	B108792	Black,Brown	Roof Core	Chrysotile 20%
	Layer 3	B108792	Brown	Insulation	None Detected
#2173-2030-1-1		B108793A	Beige	Floor Tile	Chrysotile 3%
		B108793B	Black	Mastic	Chrysotile 2%
#2173-2030-1-2		B108794		Sample Not Analyzed per COC	
#2173-2030-1-3		B108795		Sample Not Analyzed per COC	
#2173-2030-2-1		B108796A	Brick	Floor Tile	None Detected
		B108796B	Black	Mastic	Chrysotile 3%
#2173-2030-2-2		B108797A	Brick	Floor Tile	None Detected
		B108797B		Sample Not Analyzed per COC	
#2173-2030-2-3		B108798A	Brick	Floor Tile	None Detected
		B108798B		Sample Not Analyzed per COC	
#2173-2030-3-1		B108799	Red,Gray	Linoleum	Chrysotile 20%
#2173-2030-4-1		B108800A	Red,Gray	Linoleum	Chrysotile 20%
		B108800B	Yellow,Gray	Mastic	Chrysotile 2%
#2173-2030-5-1		B108801	White,Tan	Ceiling Tile	None Detected
#2173-2030-6-1		B108802	White,Tan	Ceiling Tile	None Detected
#2173-2030-7-1		B108803	Off-white	Joint Compound	Chrysotile 2%
#2173-2030-7-2		B108804		Sample Not Analyzed per COC	
#2173-2030-7-3		B108805		Sample Not Analyzed per COC	
#2173-2030-8-1		B108806A	Green	Floor Tile	Chrysotile 3%
		B108806B	Black	Mastic	Chrysotile 5%
#2173-2030-9-1		B108807A	White	Floor Tile	Chrysotile 3%
		B108807B	Black	Mastic	Chrysotile 5%

eurofins | CEI

Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Chestnut Hills Plaza, 2173 **LAB CODE: B216567**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
#2173-2030-10-1		B108808	Gray	Vibration Dampener	Chrysotile 80%
#2173-2030-11-1		B108809A	Brick,Red	Floor Tile	Chrysotile 3%
		B108809B	Black	Mastic	Chrysotile 5%
#2173-2030-11-2		B108810		Sample Not Analyzed per COC	
#2173-2030-11-3		B108811		Sample Not Analyzed per COC	
#2173-2030-12-1		B108812A	Black	Floor Tile	Chrysotile 2%
		B108812B	Black	Mastic	Chrysotile 2%
#2173-2030-13-1		B108813A	Black	Baseboard	None Detected
		B108813B	Yellow	Mastic	None Detected
#2173-2030-14-1		B108814	Gray	Expansion Joint	None Detected
#2173-2030-15-1		B108815	Black	Concrete Joint	None Detected
#2173-2030-16-1		B108816	White,Tan	Old Ceiling Tile	None Detected
#2173-2030-17-1	Layer 1	B108817	Black	Roof Field Core - Shingle	None Detected
	Layer 2	B108817	Black	Roof Field Core - Tar	None Detected
	Layer 3	B108817	Black	Roof Field Core - Felt Paper	Chrysotile 15%
	Layer 4	B108817	Brown	Roof Field Core - Insulation	None Detected
#2173-2030-18-1	Layer 1	B108818	Black	Roof Field Core - Tar	None Detected
	Layer 2	B108818	Black	Roof Field Core - Felt Paper	Chrysotile 15%
	Layer 3	B108818	Brown	Roof Field Core - Insulation	None Detected
#2173-2030-19-1	Layer 1	B108819	Silver	Silver Paint	Chrysotile 2%
	Layer 2	B108819	Black	Roof Flashing	Chrysotile 2%
	Layer 3	B108819	Black	Roof Flashing	Chrysotile 10%
#2173-2030-20-1		B108820	Black	Roof Mastic	Chrysotile 10%
#2173-2032-1-1		B108821	White	Joint Compound	None Detected
#2173-2032-1-2		B108822	White	Joint Compound	None Detected
#2173-2032-1-3		B108823	White	Joint Compound	None Detected
#2173-2032-2-1		B108824	White,Beige	Ceiling Tile	None Detected
#2173-2032-4-1		B108825A	Off-white	Floor Tile	Chrysotile 5%
		B108825B	Black	Mastic	Chrysotile 5%
#2173-2032-4-2		B108826		Sample Not Analyzed per COC	
#2173-2032-4-3		B108827		Sample Not Analyzed per COC	

eurofins | CEI

Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Chestnut Hills Plaza, 2173 **LAB CODE: B216567**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
#2173-2032-7-1		B108828A	Brown	Baseboard	None Detected
		B108828B	Brown	Mastic	None Detected
#2173-2032-8-1		B108829	Gray	Window Caulk	Chrysotile 10%
#2173-2032-9-1		B108830	Gray	Door Caulk	Chrysotile 10%
#2173-2032-10-1		B108831	White	Expansion Joint	Chrysotile 10%
#2173-2032-11-1		B108832	Black	Wood Panel Mastic	Chrysotile 3%
#2173-2032-12-1	Layer 1	B108833	Black	(2032) Roof Field Core	None Detected
	Layer 2	B108833	Brown	(2032) Roof Field Core	None Detected
	Layer 3	B108833	Brown	(2032) Roof Field Core	None Detected
#2173-2032-12-2	Layer 1	B108834	Black	(2032) Roof Field Core	None Detected
	Layer 2	B108834	Brown	(2032) Roof Field Core	None Detected
	Layer 3	B108834	Brown	(2032) Roof Field Core	None Detected

B216567

eurofins | CEI

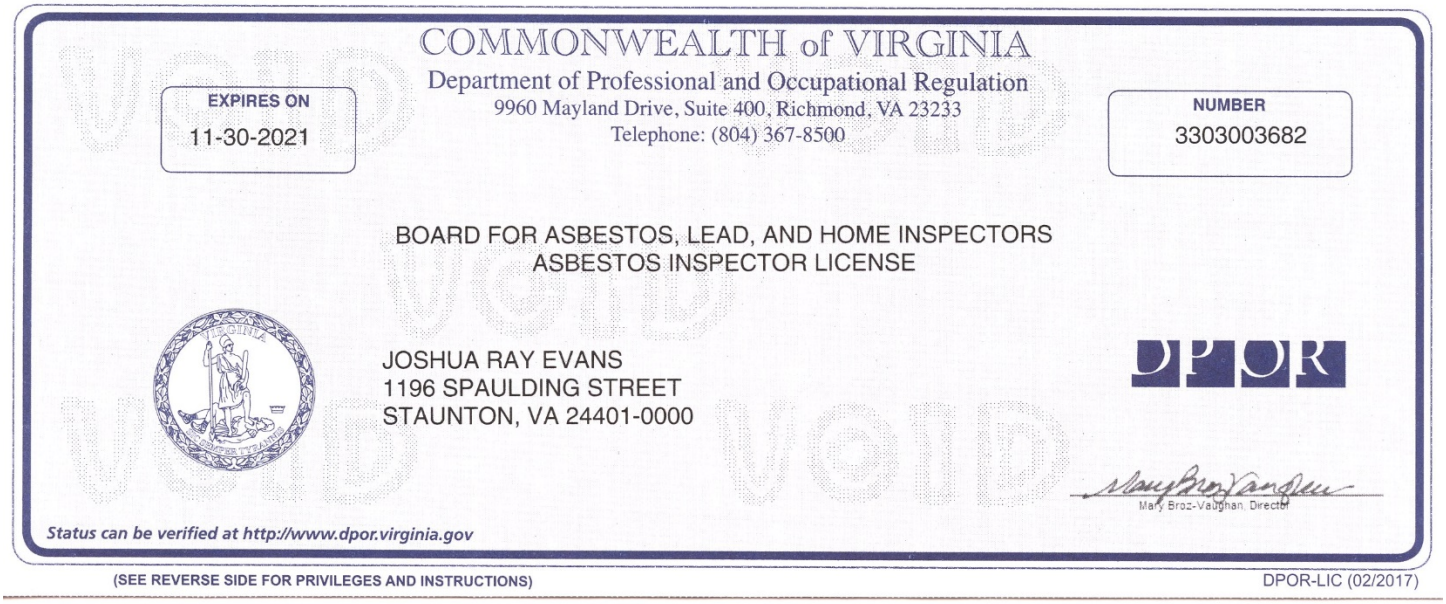
SAMPLING FORM

COMPANY CONTACT INFORMATION	
Company: DES	Job Contact: Josh Evans
Project Name: Chestnut Hills Plaza	
Project ID #: #2173	Tel: (540) 290-3373

SAMPLE ID#	DESCRIPTION / LOCATION	VOLUME/ AREA	TEST	
#2173-2024-1-1	Joint Compound		PLM ☐	TEM ☐
#2173-2024-1-2	Joint Compound		PLM ☐	TEM ☐
#2173-2024-1-3	Joint Compound		PLM ☐	TEM ☐
#2173-2024-2-1	Ceiling Tile		PLM ☐	TEM ☐
#2173-2024-3-1	Green 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2024-3-2	Green 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2024-3-3	Green 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2024-4-1	Tan 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2024-6-1	Baseboard / Mastic		PLM ☐	TEM ☐
#2173-2024-7-1	Window Caulk		PLM ☐	TEM ☐
#2173-2024-8-1	(2024,2026) Roof Field Core		PLM ☐	TEM ☐
#2173-2024-9-1	(2024,2026) Roof Drip Edge		PLM ☐	TEM ☐
#2173-2024-10-1	(2024,2026) Old Roof Mastic		PLM ☐	TEM ☐
#2173-2024-11-1	Awning Mastic		PLM ☐	TEM ☐
			PLM ☐	TEM ☐
#2173-2026-1-1	White Ceiling Tile		PLM ☐	TEM ☐
#2173-2026-2-1	Beige Ceiling Tile		PLM ☐	TEM ☐
#2173-2026-3-1	Rough Ceiling Tile		PLM ☐	TEM ☐
#2173-2026-4-1	Gray 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2026-4-2	Gray 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2026-4-3	Gray 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2026-5-1	Beige 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2026-5-2	Beige 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2026-5-3	Beige 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2026-6-1	Brown Baseboard / Mastic		PLM ☐	TEM ☐
#2173-2026-7-1	Black Baseboard / Mastic		PLM ☐	TEM ☐
#2173-2026-8-1	Linoleum		PLM ☐	TEM ☐
#2173-2026-9-1	Joint Compound		PLM ☐	TEM ☐
#2173-2026-9-2	Joint Compound		PLM ☐	TEM ☐
#2173-2026-9-3	Joint Compound		PLM ☐	TEM ☐
#2173-2026-10-1	Exterior Expansion Joint		PLM ☐	TEM ☐
#2173-2026-11-1	Window Caulk		PLM ☐	TEM ☐
#2173-2026-13-1	Wall Black Mastic		PLM ☐	TEM ☐
#2173-2026-14-1	Interior Expansion Joint		PLM ☐	TEM ☐

BC1656

#2173-2028-1-1	Joint Compound		PLM ☐	TEM ☐
#2173-2028-1-2	Joint Compound		PLM ☐	TEM ☐
#2173-2028-1-3	Joint Compound		PLM ☐	TEM ☐
#2173-2028-2-1	12x12 Floor Tile / Mastic		PLM ☐	TEM ☐
#2173-2028-2-2	12x12 Floor Tile / Mastic		PLM ☐	TEM ☐
#2173-2028-2-3	12x12 Floor Tile / Mastic		PLM ☐	TEM ☐
#2173-2028-3-1	Linoleum (Womens Bathroom)		PLM ☐	TEM ☐
#2173-2028-4-1	Smooth Ceiling Tile		PLM ☐	TEM ☐
#2173-2028-5-1	Rough Ceiling Tile		PLM ☐	TEM ☐
#2173-2028-6-1	Baseboard / Mastic		PLM ☐	TEM ☐
#2173-2028-7-1	Roof Mastic (penetrations)		PLM ☐	TEM ☐
#2173-2028-8-1	Pitch Pocket		PLM ☐	TEM ☐
#2173-2028-9-1	(2028) Roof Field Core		PLM ☐	TEM ☐
			PLM ☐	TEM ☐
#2173-2030-1-1	Beige 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2030-1-2	Beige 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2030-1-3	Beige 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2030-2-1	"Brick" 9x9 / Mastic		PLM ☐	TEM ☐
#2173-2030-2-2	"Brick" 9x9 / Mastic		PLM ☐	TEM ☐
#2173-2030-2-3	"Brick" 9x9 / Mastic		PLM ☐	TEM ☐
#2173-2030-3-1	Wall Linoleum / Top Layer		PLM ☐	TEM ☐
#2173-2030-4-1	Wall Linoleum / Bottom Layer		PLM ☐	TEM ☐
#2173-2030-5-1	Smooth Ceiling Tile		PLM ☐	TEM ☐
#2173-2030-6-1	Rough Ceiling Tile		PLM ☐	TEM ☐
#2173-2030-7-1	Joint Compound		PLM ☐	TEM ☐
#2173-2030-7-2	Joint Compound		PLM ☐	TEM ☐
#2173-2030-7-3	Joint Compound		PLM ☐	TEM ☐
#2173-2030-8-1	Green 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2030-9-1	White 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2030-10-1	HVAC Vibration Dampener		PLM ☐	TEM ☐
#2173-2030-11-1	"Brick" 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2030-11-2	"Brick" 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2030-11-3	"Brick" 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2030-12-1	Black 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2030-13-1	Black Baseboard / Mastic		PLM ☐	TEM ☐
#2173-2030-14-1	Expansion Joint		PLM ☐	TEM ☐
#2173-2030-15-1	Concrete Joint		PLM ☐	TEM ☐
#2173-2030-16-1	"old" Ceiling Tile		PLM ☐	TEM ☐
#2173-2030-17-1	(2030) Roof Field Core		PLM ☐	TEM ☐
#2173-2030-18-1	(2030) HVAC Mezzanine Roof Field Core		PLM ☐	TEM ☐
#2173-2030-19-1	(2030) Roof Flashing		PLM ☐	TEM ☐
#2173-2030-20-1	(2030) Roof Mastic		PLM ☐	TEM ☐
			PLM ☐	TEM ☐
#2173-2032-1-1	Joint Compound		PLM ☐	TEM ☐
#2173-2032-1-2	Joint Compound		PLM ☐	TEM ☐
#2173-2032-1-3	Joint Compound		PLM ☐	TEM ☐
#2173-2032-2-1	Ceiling Tile		PLM ☐	TEM ☐
#2173-2032-4-1	Brown 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2032-4-2	Brown 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2032-4-3	Brown 12x12 / Mastic		PLM ☐	TEM ☐
#2173-2032-7-1	Baseboard / Mastic		PLM ☐	TEM ☐
#2173-2032-8-1	Window Caulk		PLM ☐	TEM ☐
#2173-2032-9-1	Door Caulk		PLM ☐	TEM ☐
#2173-2032-10-1	Expansion Joint		PLM ☐	TEM ☐
#2173-2032-11-1	Wood Panel Mastic		PLM ☐	TEM ☐
#2173-2032-12-1	(2032) Roof Field Core		PLM ☐	TEM ☐
#2173-2032-12-2	(2032) Roof Field Core		PLM ☐	TEM ☐
			PLM ☐	TEM ☐
			PLM ☐	TEM ☐
			PLM ☐	TEM ☐
			PLM ☐	TEM ☐



COMMONWEALTH of VIRGINIA

Department of Professional and Occupational Regulation

9960 Mayland Drive, Suite 400, Richmond, VA 23233

Telephone: (804) 367-8500

EXPIRES ON

11-30-2021

NUMBER

3303003682

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS

ASBESTOS INSPECTOR LICENSE

JOSHUA RAY EVANS

1196 SPAULDING STREET

STAUNTON, VA 24401-0000

DPOR

Mary Broz-Vaughan, Director

Status can be verified at http://www.dpor.virginia.gov

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (02/2017)

COMMONWEALTH of VIRGINIA

Department of Professional and Occupational Regulation
9960 Mayland Drive, Suite 400, Richmond, VA 23233
Telephone: (804) 367-8500

EXPIRES ON
04-30-2022

NUMBER
3303000697

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS INSPECTOR LICENSE

PATRICK ANGELO DIFLORIO
603 ALLEGHANY AVENUE
STAUNTON, VA 24401-0000

DPOR

Mary Broz-Vaughan, Director

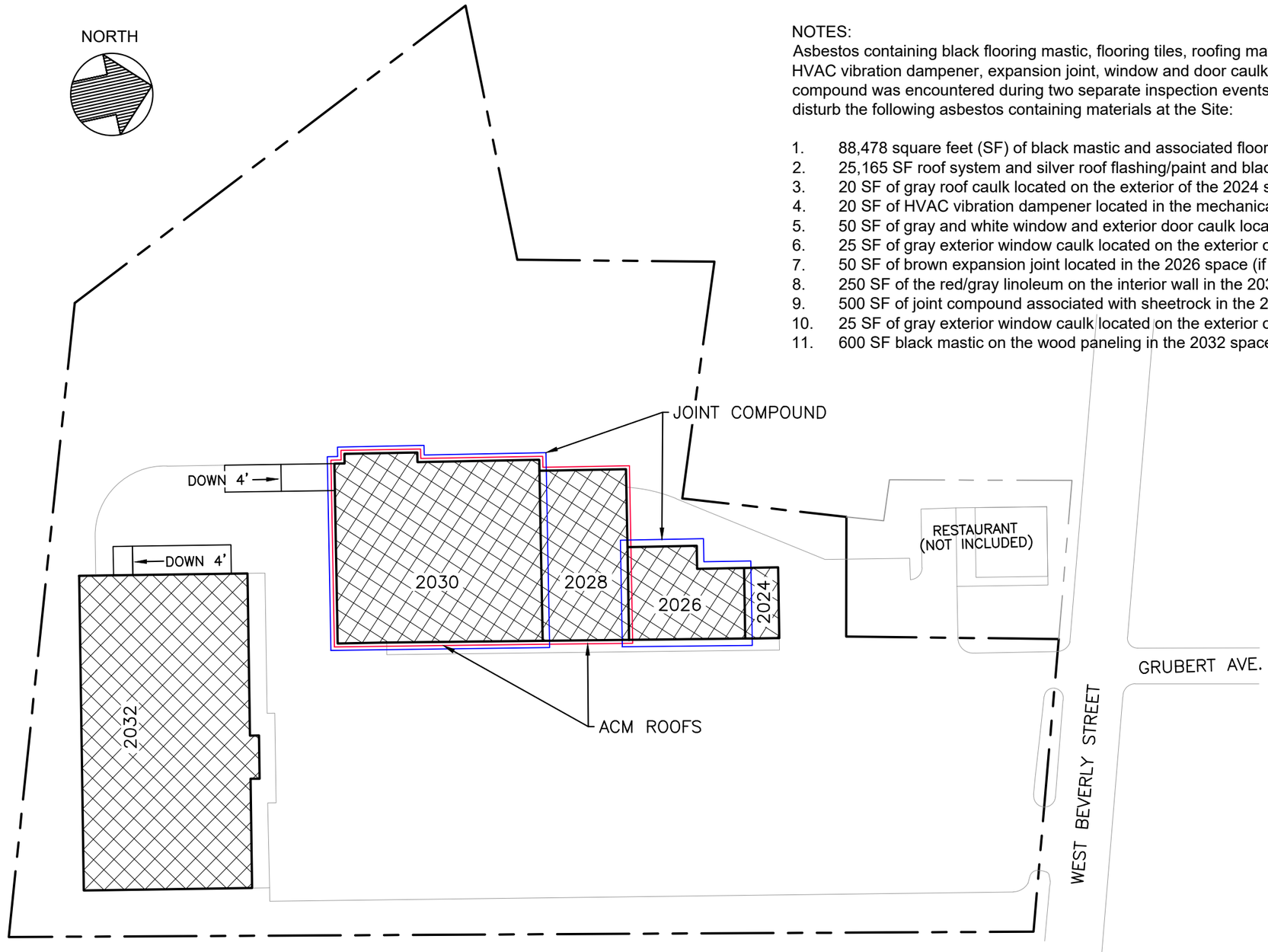
Status can be verified at http://www.dpor.virginia.gov

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (02/2017)

NOTES:
Asbestos containing black flooring mastic, flooring tiles, roofing materials including roof core/mastics, roof flashing and silver paint, HVAC vibration dampener, expansion joint, window and door caulk, wood paneling and cove base mastic and drywall system joint compound was encountered during two separate inspection events at the Site. It has been determined that renovation activities will disturb the following asbestos containing materials at the Site:

1. 88,478 square feet (SF) of black mastic and associated flooring located through the footprint of both Site structures.
2. 25,165 SF roof system and silver roof flashing/paint and black roof mastic located on the main roof of the 2028 and 2030 space.
3. 20 SF of gray roof caulk located on the exterior of the 2024 space.
4. 20 SF of HVAC vibration dampener located in the mechanical area of the 2030 space.
5. 50 SF of gray and white window and exterior door caulk located on the exterior of the 2032 space.
6. 25 SF of gray exterior window caulk located on the exterior of the 2026 space.
7. 50 SF of brown expansion joint located in the 2026 space (if owner designates walls for demolition)
8. 250 SF of the red/gray linoleum on the interior wall in the 2030 space.
9. 500 SF of joint compound associated with sheetrock in the 2026 and 2030 space.
10. 25 SF of gray exterior window caulk located on the exterior of the 2032 space.
11. 600 SF black mastic on the wood paneling in the 2032 space.



LEGEND

PROPERTY LINE

BLACK MASTIC
ASSOCIATED FLOORING

GRAPHIC SCALE

100 0 50 100 200

(IN FEET)
1 inch = 100 ft.

TRC ENGINEERS, INC.
2200 South Main Street
Suite A
Blacksburg, VA 24060
540-552-0444
Fax: 540-552-0291

DESIGNED	AS
DRAWN	DLD
CHECKED	AS
DATE	11/28/2022

SPCC
CHESTNUT HILL SHOPPING CENTER
CITY OF STAUNTON, VIRGINIA

SCALE: 1"=100'

PLAN NO. 018244

FIGURE
1

C:\Users\DDalton\OneDrive - TRC\Documents\CHESTNUT HILL SC.dwg Dec 01, 2022 1:28pm

Appendix E – Certifications

COMMONWEALTH of VIRGINIA

Department of Professional and Occupational Regulation
9960 Mayland Drive, Suite 400, Richmond, VA 23233
Telephone: (804) 367-8500

EXPIRES ON
01-31-2023

NUMBER
3303003090

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS INSPECTOR LICENSE

ANDRE PETER STEUER
1308 BILLMYER MILL RD
SHEPHERDSTOWN, WV 25443-0000

DPOR

Demetrios J. Melis, Director

Status can be verified at http://www.dpor.virginia.gov

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (02/2017)

(DETACH HERE)

DPOR COMMONWEALTH of VIRGINIA
Department of Professional and Occupational Regulation

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS INSPECTOR LICENSE
NUMBER: 3303003090 EXPIRES: 01-31-2023

ANDRE PETER STEUER
1308 BILLMYER MILL RD
SHEPHERDSTOWN, WV 25443-0000

(FOLD)

Status can be verified at http://www.dpor.virginia.gov

DPOR-PC (02/2017)

WEST VIRGINIA

Asbestos Program

Andre' P. Steuer

IS LICENSED AS AN
ASBESTOS INSPECTOR

License #: AI010282
Issued: 8/1/2022
Expires: 8/31/2023

Director
WV OEHS