

DOCUMENT 000101 - PROJECT TITLE PAGE

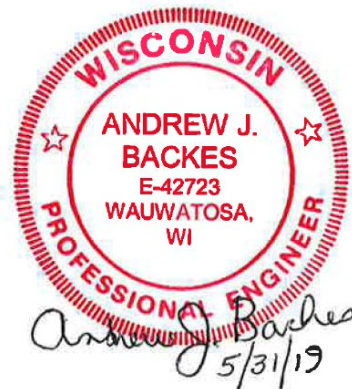
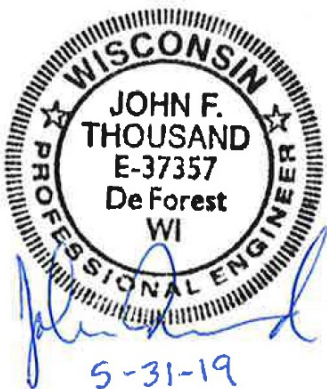
1.1 PROJECT MANUAL VOLUME 1 Bid Set

- A. Oneida Elder Services and Apartment Improvements.
- B. Oneida Nation.
- C. Oneida, Wisconsin.
- D. Owner Project No. 05-013.
- E. Architect Project No. 2018085.



- F. Oneida Total Integrated Enterprises (OTIE)
- G. 2555 Packerland Dr.
- I. Green Bay, WI 54313.
- J. 920-884-3959
- K. Website: www.otie.com
- L. Issued: June 4th 2019
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ONEIDA NATION
ELDER SERVICE/APARTMENTS IMPROVEMENTS
C.I.P.# 05-013
MASTER SPECIFICATIONS
TABLE OF CONTENTS
Section 00 00 10

SECTION NUMBER	DIVISION/SECTION NUMBER
	DIVISION 00 – Procurement and Contracting Requirements
00 01 15	List of Drawing Sheets
00 11 16	Invitation to Bid
00 21 13	Instruction to Bidders
00 22 00	Indian Preference Vendors
00 31 43	Permit Fee Schedule
00 41 13	Bid Form
00 43 22	Unit Prices Form
00 43 23	Alternates Form
00 60 00	Project Forms
00 73 35	Indian Preference Law
00 73 43	Wage Rate Determination
	DIVISION 01 - GENERAL REQUIREMENTS
01 10 00	Summary
01 25 00	Substitution Procedures
01 26 00	Contract Modification Procedures
01 29 00	Payment Procedures
01 31 00	Project Management and Coordination
01 32 00	Construction Progress Documentation
01 32 33	Photographic Documentation

01 33 00	Submittal Procedures
01 35 16	Alteration Project Procedures
01 40 00	Quality Requirements
01 42 00	References
01 60 00	Product Requirement
01 73 00	Execution
01 74 19	Construction Waste Management and Disposal
01 77 00	Closeout Procedures
01 78 23	Operation and Maintenance Data
01 78 39	Project Record Documents
01 79 00	Demonstration and Training
	DIVISION 02 – EXISTING CONDITIONS
02 41 19	Selective Demolition
	DIVISION 06 – WOOD, PLASTICS AND COMPOSITES
06 10 00	Rough Carpentry
06 16 00	Sheathing
06 20 00	Finish Carpentry
	DIVISION 07 – THERMAL AND MOISTURE PROTECTION
07 13 00	Sheet Waterproofing
07 21 00	Building Insulation
07 21 13	Thermal Insulation
07 21 60	Spray Applied Plastic Foam Insulation
07 27 26	Fluid Applied Membrane Air Barriers
07 31 13	Asphalt Shingles
07 46 46	Fiber Cement Siding

07 53 23	EPDM Roofing
07 62 00	Sheet Metal Flashing and Trim
07 72 00	Roof Accessories
07 84 13	Penetration Firestopping
07 92 00	Joints and Sealants
	DIVISION 08 - OPENINGS
08 11 13	Hollow Metal Doors and Frames
08 14 00	Interior Wood Doors
08 14 16	Flush Wood Doors
08 31 13	Access Doors and Frames
08 36 13	Overhead Sectional Doors
08 71 00	Door Hardware
08 71 13	Automatic Door Operators
08 80 00	Glazing
	DIVISION 09 – FINISHES
09 29 00	Gypsum Board
09 30 13	Ceramic/Porcelain Tiling
09 51 00	Acoustical Ceilings
09 65 13	Resilient Base and Accessories
09 65 19	Resilient Tile Flooring
09 68 13	Carpet Tiles
09 91 00	Painting
09 91 13	Exterior Painting
	DIVISION 10 – SPECIALTIES
10 28 00	Toilet and Bath Accessories

10 44 16	Fire Extinguishers
	DIVISION 22 – PLUMBING
22 05 13	Common Motor Requirements for Plumbing Equipment
22 05 17	Sleeves and Sleeve Seals for Plumbing Piping
22 05 18	Escutcheons for Plumbing Piping
22 05 23.12	Ball Valves for Plumbing Piping
22 05 23.14	Check Valves for Plumbing Piping
22 05 29	Hangers and Supports for Plumbing Piping and Equipment
22 05 53	Identification for Plumbing Piping and Equipment
22 07 19	Plumbing Piping Insulation
22 11 16	Domestic Water Piping
22 11 19	Domestic Water Piping Specialties
22 13 16	Sanitary Waste and Vent Piping
22 13 19	Sanitary Waste Piping Specialties
22 13 19.13	Sanitary Drains
22 14 13	Facility Storm Drainage Piping
22 14 23	Storm Drainage Piping Specialties
22 33 00	Electric, Domestic Water Heaters
22 41 00	Residential Plumbing Fixtures
22 45 00	Emergency Plumbing Fixtures
	DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
23 05 13	Common Motor Requirements for HVAC Equipment
23 05 17	Sleeves and Sleeve Seals for HVAC Piping
23 05 18	Escutcheons for HVAC Piping
23 05 23.11	Globe Valves for HVAC Piping
23 05 23.12	Ball Valves for HVAC Piping

23 05 29	Hangers and Supports for HVAC Piping and Equipment
23 05 48	Vibration and Seismic Controls for HVAC
23 05 53	Identification for HVAC Piping and Equipment
23 07 13	Duct Insulation
23 07 19	HVAC Piping Insulation
23 09 23	Direct Digital Control (DDC) System for HVAC
23 09 93.11	Sequence of Operations for HVAC DDC
23 11 23	Facility Natural-Gas Piping
23 23 00	Refrigerant Piping
23 31 13	Metal Ducts
23 33 00	Air Duct Accessories
23 34 16	Centrifugal HVAC Fans
23 37 13.13	Air Diffusers
23 37 13.23	Registers and Grilles
23 37 23	HVAC Gravity Ventilators
23 41 00	Particulate Air Filtration
23 74 23.16	Packaged, Indirect-Fired, Outdoor, Heating-Only Makeup-Air Units
23 81 26	Split-System Air-Conditioners
23 82 39.19	Wall and Ceiling Unit Heaters
	DIVISION 26 - ELECTRICAL
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Raceways and Boxes for Electrical Systems
26 05 44	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
26 05 53	Identification for Electrical Systems
26 09 23	Lighting Control Devices

26 24 16	Panelboards
26 27 26	Wiring Devices
26 28 16	Enclosed Switches and Circuit Breakers
26 51 19	LED Interior Lighting
26 52 13	Emergency and Exit Lighting
26 56 19	LED Exterior Lighting
	DIVISION 31 – EARTHWORK
31 20 00	Earthmoving
31 22 16.15	Roadway Subgrade Preparation
31 23 16.13	Trenching
31 25 00	Erosion Control
	DIVISION 32 – EXTERIOR IMPROVEMENTS
32 11 23.33	Dense Graded Base
32 12 16.13	Plant Mix Asphalt Paving
32 17 23	Pavement Markings
	DIVISION 33 – UTILITIES
33 11 00	Water Utility Distribution Piping
33 40 00	Storm Drainage Utilities

DOCUMENT 000115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

- A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Elder Services and Apartment Improvement, dated 05-31-2019, as modified by subsequent Addenda and Contract modifications.

END OF DOCUMENT 000115

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DOCUMENT 001116 - INVITATION TO BID

1.1 PROJECT INFORMATION

- A. Notice to Bidders: Bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.
- B. Project Identification: Elder Service/Apartment Improvements, Project Number 05-013.
 - 1. Project Location: 2907 S. Overland Drive, Oneida, WI 54155
- C. Owner: Oneida Nation, P.O. Box 365 Oneida, WI 54155.
 - 1. Owner's Representative: Oneida Engineering Department, Little Bear Development Center, N7332 Water Circle Place, Oneida, WI 54155.
- D. Architect: Oneida Total Integrated Enterprises (OTIE), 2555 Packerland Dr., Green Bay, WI 54313.
- E. Project Description: Project consists of the construction of four (4) multi stall resident garages attached to existing structure with an enclosed walkway. Garages and walkway will be constructed with cast-in place foundations, wood framed structural shear walls and prefabricated roof trusses. The project also includes the construction of a 4,000 SF building to accommodate a garage, workshop, storage, office and a bathroom. The building will be attached to the existing structure on 2 sides and consist of cast-in-place foundations, structural steel frames, wood shear wall, and prefabricated roof trusses. Siding on the existing structure will also be replaced.
- F. Construction Contract: Bids will be received for the following Work:
 - 1. General Contract (all trades).

1.2 BID SUBMITTAL AND OPENING

- A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:
 - 1. Bid Date: June 27, 2019.
 - 2. Bid Time: 2:00 p.m., local time.
 - 3. Location: Oneida Engineering Department, Little Bear Development Center, N7331 Water Circle Place, Oneida WI 54155
- B. Bids will be thereafter publicly opened and read aloud.

1.3 BID SECURITY

- A. Bid security shall be submitted with each bid in the amount of 5 percent of the bid amount. No bids may be withdrawn for a period of 60 days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

1.4 PREBID CONFERENCE

- A. A prebid conference for all bidders will be held at Elder Services site on 06-12-2019 at 10:00 a.m., local time. Prospective bidders are requested to attend.

1.5 DOCUMENTS

- A. Online Procurement and Contracting Documents: Obtain access after 06-04-2019 by contacting Oneida Engineering Department, Little Bear Development Center, N7332 Water Circle Place, Oneida, WI 54155. Online access will be provided to all registered bidders and suppliers.

1.6 TIME OF COMPLETION

- A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time.

1.7 BIDDER'S QUALIFICATIONS

- A. Bidders must be prequalified by Owner.
- B. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner may be required of the successful Bidder.

END OF DOCUMENT 001116

DOCUMENT 002113 - INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS

- A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.
 - 1. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.

END OF DOCUMENT 002113

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AIA[®] Document A701[™] – 2018

Instructions to Bidders

for the following Project:

(Name, location, and detailed description)

THE OWNER:

(Name, legal status, address, and other information)

THE ARCHITECT:

(Name, legal status, address, and other information)

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 |

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.

ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

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

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

§ 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.

§ 3.3 Substitutions

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

§ 3.3.2 Substitution Process

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

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

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

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

§ 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.)

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

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

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

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

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

§ 4.2 Bid Security

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

(Insert the form and amount of bid security.)

§ 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.)

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

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

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

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

§ 4.4 Modification or Withdrawal of Bid

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

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

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

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

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

§ 5.2 Rejection of Bids

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

§ 5.3 Acceptance of Bid (Award)

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

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

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

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

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

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

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

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

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. 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 and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

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

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

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

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

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

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

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

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

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

.5 Drawings

Number	Title	Date
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.6 Specifications

Section	Title	Date	Pages
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.7 Addenda:

Number	Date	Pages
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.8 Other Exhibits:

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

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

☐ The Sustainability Plan:

Title	Date	Pages
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☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
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.9 Other documents listed below:

(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

Document 00 22 01 – INDIAN PREFERENCE VENDORS

1. GENERAL

1.1. INDIAN PREFERENCE VENDORS

- A. The Certified Indian Owned Businesses on the list following this section, will be notified of the project and can submit sub-bids to the General Contractors for portions of the Work.
- B. If Certified Indian Owned Businesses wish to bid as a General Contractor, they are still required to get sub-bids from other Certified Indian Owned Businesses.
- C. The Oneida Nation will notify the Certified Indian Owned Business List, informing them of the project and providing them a listing of the invited General Contractors or the listing of current plan holders on public bid projects.
 - 1. General Contractors shall still contact Certified Indian Owned Businesses to attempt to get bids.
- D. Comparison of Certified Indian Owned Business bids to non-Indian owned business bids will be made during the post-bid evaluation, at percentages denoted in the Oneida Indian Preference in Contracting Law.
- E. For questions regarding the Certified Indian Owned Business list, please contact:

Travis Wallenfang - Indian Preference Coordinator
Skenandoah Complex
909 Packerland Drive
Green Bay, WI 54303

PH: 920-496-5316
FAX: 920-496-7491
E-Mail: twallenf@oneidanation.org

END OF 00 22 01 – INDIAN PREFERENCE VENDORS

**INDIAN PREFERENCE DEPARTMENT – CERTIFIED INDIAN OWNED BUSINESS LIST
FOLLOWS**

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Indian Preference Vendor List

Skenandoah Complex

909 Packerland Drive

P.O. Box 365 Oneida, WI 54155

920.496.5316 Office, 920.496.7491 Fax

February 2019

Table of Contents

<u>AD SPECIALTIES ITEMS</u>	3
<u>ADVERTISING</u>	3
<u>APPAREL AND CLOTHING</u>	3
<u>ARCHITECTURE</u>	3
<u>ASBESTOS AND LEAD ABATEMENT</u>	3
<u>ASPHALT SERVICES</u>	3
<u>AUDIO/VISUAL</u>	4
<u>AUTO BODY & SERVICE</u>	4
<u>BAKERY</u>	4
<u>BUILDING/REMODEL</u>	4
<u>BUILDING MATERIALS & SUPPLIES</u>	5
<u>CIVIL/INFRASTRUCTURE ENGINEERING</u>	5
<u>CLEANING SERVICE/COMERCIAL & RESIDENTIAL</u>	5
<u>COMMUNICATION</u>	5
<u>COMMUNITY EVENTS/ORGANIZING</u>	6
<u>CONCRETE</u>	6
<u>CONFERENCE ROOMS</u>	6
<u>CONFERENCE AND TRADE SHOWS</u>	6
<u>CONSTRUCTION</u>	6
<u>CONSTRUCTION & INDUSTRIAL SUPPLIES</u>	7
<u>CONSTRUCTION MANAGEMENT</u>	8
<u>CONSULTANT</u>	8
<u>CONSULTANT-COMPUTER PROGRAMING</u>	9
<u>DEMOLITION</u>	9
<u>DRAFTING SERVICES</u>	9
<u>DRYWALL AND PLASTERING</u>	9
<u>EARTHWORK</u>	10
<u>ELECTRICIAL</u>	10
<u>EMBROIDERY</u>	10
<u>ENGINEERING SERVICES</u>	10
<u>ENVIROMENTAL SERVICES</u>	10
<u>FINANCE</u>	11
<u>FLOORING</u>	11
<u>FLOWERS</u>	12
<u>FOOD SERVICE</u>	12
<u>GAMING EQUIPMENT/UNIFORMS</u>	12
<u>GENERAL CONTRACTOR</u>	12
<u>INSURANCE</u>	13
<u>INTERIOR DESIGN SERVICES</u>	13

<u>INTER-TRIBAL DEPARTMENTS & ENTERPRISES</u>	13
<u>LANDSCAPE & LAWN CUTTING</u>	14
<u>MECHANICAL CONTRACTOR (HVAC)</u>	14
<u>MEDIA</u>	15
<u>NATIVE ART</u>	15
<u>PAINTING</u>	15
<u>PHOTOGRAPHER</u>	15
<u>PLUMBING</u>	15
<u>PRESSURE WASH CLEANING – INDUSTRIAL/COMMERCIAL/RESIDENTIAL</u>	15
<u>PRINT BROKER / PRINT SUPPLIES</u>	16
<u>PRINT SHOP</u>	16
<u>RETAIL</u>	16
<u>ROOFING</u>	ERROR! BOOKMARK NOT DEFINED.
<u>SAND SALES & GRAVEL</u>	16
<u>SAFETY CONSULTING</u>	16
<u>SNOWPLOWING, RESIDENTIAL/COMMERCIAL</u>	16
<u>TELECOMMUNICATIONS</u>	17
<u>TELEPHONE/POLLING SERVICES</u>	17
<u>TOWING</u>	ERROR! BOOKMARK NOT DEFINED.
<u>TRUCKING</u>	17

AD SPECIALTIES ITEMS

Iroquois Bay 3927 South Iowa Ave. St. Francis, WI. 53235 E-Mail: Michael@iroquoisbay.com E-Mail: tammy@iroquoisbay.com	Tammy L. Przytarski Vendor #127480 Oneida Vendor NAICS Codes www.iroquoisbay.com	(414) 727-2471 (414) 769-9174 fax
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RCI Services, LLC P.O. Box 4792 Hilo, Hawaii 96720 E-Mail: rciservicesllc@yahoo.com	Rudolph & Jadeen Webster Vendor # 116694 Oneida Vendor NAICS Codes	(808) 968-1591 (808) 968-1592 fax (808) 756-6576 cell
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Thundercloud Native American Art 1412 Chief Hill Drive Green Bay, WI. 54313 E-Mail: smwolf2004@yahoo.com	JoAnne Thundercloud Vendor #133369 Oneida Vendor NAICS Codes	(920) 785-1790
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ADVERTISING

HVS Advertising-Marketing 2021 S. Webster Avenue Green Bay, WI. 54301-0723 E-Mail: Ron@hvsproductions.com	Ronald Peterson Vendor #106885 Oneida Vendor NAICS Codes MBE Certified	(920) 430-5131 (920) 430-5126 fax
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APPAREL AND CLOTHING

Iroquois Bay 3927 South Iowa Ave. St. Francis, WI. 53235 E-Mail Address: Michael@iroquoisbay.com E-Mail Address: tammy@iroquoisbay.com	Tammy L. Przytarski Vendor #127480 Oneida Vendor NAICS Codes www.iroquoisbay.com	(414) 727-2471 (414) 769-9174 fax
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ASBESTOS AND LEAD ABATEMENT

Mission Support Services 1033 N. Mayfair Road, Suite 202 Milwaukee, WI. 53226 E-Mail: hcotey@oescgroup.com Web Site: www.ms2llc.com	Heather Cotey Vendor #144118 Oneida Vendor SBA Certified	(414) 607-6728 (414) 257-2492 fax
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ARCHITECTURE SERVICES

Seven Generations Architecture & Engineering, LLC 4664 Campus Drive, Suite 101 Kalamazoo, MI 49008 E-Mail: jberg@7genae.com Web Site: www.7GenAE.com	Jeremy Berg Vendor # Oneida Vendor SBA 8(a) SDB, HUB zone Certified	(269)927-0144 (269)585-2251
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ASPHALT SERVICES

Arrow Maintenance, LLC. W805 Daniel Court De Pere, WI. 54115 E-Mail : arrowpavementmaint@yahoo.com	Clyde Skenandore Sr. Clyde Skenandore Jr. Vendor #130016 Oneida Vendor	(920) 371-3635 (920) 869-1826 fax
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AUDIO/VISUAL

HVS Advertising-Marketing 2021 A. Webster Avenue Green Bay, WI. 54301-0723 E-Mail: Ron@hvsproductions.com	Ronald Peterson Vendor #106885 Oneida Vendor NAICS Codes MBE Certified	(920) 430-5131 (920) 430-5126 fax
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PM Productions 1541 Western Ave. Green Bay WI, E-Mail: pmetox@yahoo.com	Pat Metoxen Vendor #109273 Oneida Vendor NAICS Codes	(920) 713-8350
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AUTO BODY & SERVICE

Dipsticks, LLC N7283 Cty. Trunk U P.O. Box 115 Oneida, WI. 54155 E-Mail: chadwick@dipsticksautomotive.com Derrick@dipsticksautomotive.com Website: www.dipsticksautomotive.com	Chad & Derrick Doxtator Vendor #NONE Oneida Vendor NAICS Codes	(920) 869-18861 (920) 725-7080 fax
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Goss Auto Body, Inc. & Midway Service Center & Repair 629 Olde Midway Road Menasha, WI. 54952 E-Mail: Ronnie@gossautobody.com Website: www.gossautobody.com	Ronald Goss Vendor #NONE Oneida Vendor	(920) 810-7487 cell (920) 725-2022 (920) 725-7080 fax
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Integrity Towing LLC 5910 Old HWY 29 Road Oneida, WI. 54155 E-Mail: j.johnsonccc@yahoo.com	Joseph K Johnson Vendor #NONE Oneida Vendor	(920) 366-2235 cell (920) 869-2255
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Web's Kustom Touch Auto Body 3792 Cty Rd U Oneida, WI. 54155 Email webskrap@yahoo.com	Donald & Jennifer Webster Vendor #104568 Oneida Vendor	(920) 869-WEBS
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BAKERY

WT Creations/Sister Bread 2425 O'Connor Rd. Green Bay, WI 54313 E-Mail: corincharl@aol.com	Corina Thomas Vendor #109236 Oneida Vendor	(920) 869-1370 (920) 713-6793 cell
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BUILDING/REMODEL

Arrow Maintenance, LLC. W805 Daniel Court De Pere, WI. 54115 E-Mail: arrowpavementmaint@yahoo.com	Clyde Skenandore Sr. Clyde Skenandore Jr. Vendor #130016 Oneida Vendor	(920) 371-3635 (920) 869-1826 fax
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Green Bay Area Builders 1172 Ashwaubenon Street Green Bay, WI. 54304141472 E-Mail: natalie@greenbayab.com Web Site: www.greenbayab.com	Natalie Rose Paul Rose Vendor #141472 Oneida Vendor	(920) 632-4309 cell (920) 265-8295 cell (888) 959-6350 fax
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LDF-CCI Construction LLC 14284 Hwy 70 W, P.O. Box 155 Lac du Flambeau E-Mail: Max.smith@ldf-construction.com Web Site: www.ldf-construction.com Web Site: www.cciwi.com	William Benson Jerry Stodela Vendor # 142885	(715) 388-0500 (866) 423-6104 fax
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Mission Support Services 1033 N. Mayfair Road, Suite 202 Milwaukee, WI. 53226 E-Mail: hcotey@oescgroup.com Web Site: www.ms2llc.com	Heather Cotey Vendor #144118 Oneida Vendor SBA Certified	(414) 607-6728 (414) 257-2492fax
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BUILDING MATERIALS & SUPPLIES

Menominee Tribal Enterprises PO Box 10 Neopit, WI. 54135 Email: kimz@mtewood.com Email: joeb@mtewood.com	Joe Besaw Vendor # 101288 Indian Vendor	(715) 756-2311 (715) 756-2386 fax
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Ojibwa Building Supply Company 804 U.S. 41 South Baraga, MI. 49908 Email: Perrault@up.net Website: www.ojibwa.doitbest.com	Kevin Perrault Vendor # NONE Indian Vendor	(906) 353-8850 (o) (906) 395-5565 (c) (906) 353-8851 fax
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CIVIL/INFRASTRUCTURE ENGINEERING

Oneida Total Integrated Enterprise 2555 Packerland Drive Green Bay, WI. 54313 E-Mail: mkunstman@otie.com Website: www.otiesolutions.com	Matt Kunstman Vendor #134114 Oneida Vendor SBA Certified	(920) 360-6710 cell (920) 884-3970 (920) 884-3989 fax
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CLEANING SERVICE/COMERCIAL & RESIDENTIAL

Dirtbusters, LLC 822 Gross Court Green Bay, WI. 54304 E-Mail: Kathy@dirtbustersgb.com	Michael Goodeve Vendor # NONE Oneida Vendor	(920) 217-8144
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COMMUNICATION

HVS Advertising-Marketing 2021 S. Webster Avenue Green Bay, WI. 54301-0723 E-Mail: Ron@hvsproductions.com MBE Certified	Ronald Peterson Vendor #106885 Oneida Vendor	(920) 430-5131 (920) 430-5126 fax
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COMMUNITY EVENTS/ORGANIZING

RCI Services, LLC P.O. Box 4792 Hilo, Hawaii 96720 E-Mail: rciservicesllc@yahoo.com	Rudolph & Jadeen Webster Vendor # NONE Oneida Vendor	(808) 968-1591 (808) 968-1592 fax (808) 756-6576 cell
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CONCRETE

Joe Johnson Concrete 510 North 10 th Street Depere, WI 54115 E-Mail: jjohnsonccc@yahoo.com Website www.joejohnsonconstruction.com	Joe Johnson (Owner) Vendor # 133368 Oneida Vendor	(920)-366-2239 cell
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LDF-CCI Construction LLC 14284 Hwy 70 W, P.O. Box 155 Lac du Flambeau E-Mail: Max.smith@ldf-construction.com Web Site: www.ldf-construction.com Web Site: www.cciwi.com	William Benson Jerry Stodela Vendor # 142885	(715) 388-0500 (866) 423-6104 fax
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CONFERENCE ROOMS

Radisson Hotel & Conference Center 2040 Airport Drive Green Bay, WI. 54311 Website: www.radisson.com/greenbaywi	Oneida Airport Hotel Corp. Vendor #100047 Oneida Vendor	(920) 494-7300 (920) 494-9599 fax
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CONFERENCE AND TRADE SHOWS

The Hill Group, LLC P.O. Box 353 Oneida, WI 54155 E-Mail: dawnr@thehillgroup.org MBE Certified	Richard G. Hill Dawn Reiter Vendor # NONE Oneida Vendor	(920) 265-1567 RH (920) 737-2814 DR (920) 869-2944
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CONSTRUCTION

Arrow Maintenance, LLC. W805 Daniel Court De Pere, WI. 54115 E-Mail: arrowpavementmaint@yahoo.com	Clyde Skenandore Sr. Clyde Skenandore Jr. Vendor #130016 Oneida Vendor	(920) 371-3635 (920) 869-1826 fax
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Boivin Excavating LLC P.O. Box 1231 Keshena, WI 54135 E-Mail: boivinexcavatingllc@gmail.com	Stewart Boivin Jr. Vendor #141409 Oneida Vendor	(715) 304-9812 (920) 915-1531
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Carl's Trucking W129 Bain Road De Pere, WI. 54115 E-Mail: carltrucking@earthlink.net MBE Certified	Carlton S. Jordan Vendor #130571 Oneida Vendor	(920) 338-1623 (920) 338-1624 fax (920) 621-0512 cell
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reen Bay Area Builders 1172 Ashwaubenon Street Green Bay, WI. 54304 E-Mail: natalie@greenbayab.com Web Site: www.greenbayab.com	Natalie Rose Paul Rose Vendor #141472 Oneida Vendor	(920) 632-4309 cell (920) 265-8295 cell (888) 959-6350 fax
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JDW Construction, Inc. 3328 Park Rd Greenleaf, WI 54126 E-Mail: jdwconstructioninc@yahoo.com	Dawn & John Wroblewski Vendor # NONE Oneida Vendor	(920) 819-9140 cell (920) 864-7924 fax
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LDF Construction LLC 14284 Hwy 70 W, P.O. Box 155 Lac du Flambeau E-Mail: Max.smith@ldf-construction.com Web Site: www.ldf-construction.com	Max Smith Christy Jackson Vendor # 142885	M: (715) 388-0500 C: (608) 772-8813 (866) 423-6104 fax
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Mission Support Services 1033 N. Mayfair Road, Suite 202 Milwaukee, WI. 53226 E-Mail: hcotey@oescgroup.com Web Site: www.ms2llc.com	Heather Cotey Vendor #144118 Oneida Vendor SBA Certified	(414) 607-6728 (414) 257-2492 fax
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Mavid Construction Services, LLC. 1609 Western Avenue, Suite A Green Bay, WI. 54304 E-Mail: Zoar@mavidconstruction.com Website:	Zoar Fulwilder David Montiel Edward Martin Vendor # NONE Indian Vendor	(920) 965-0271 (o) (888) 494-0504 fax 920) 655-6023 cell
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McAlvain Construction, Inc. 5559 W. Gowen Road Boise, Idaho 83709 E-Mail: torry@mc Alvain.com Website: www.mcalvain.com	Torry McAlvain Vendor #NONE Indian Vendor	(208) 362-2125 (208) 362-4356 fax (208) 870-9336 cell
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White Buffalo Trucking LLC. W1357 Tall Feather Way Seymour, WI. 54115 E-Mail: ahacker1@new.rr.com DBE Certified	Amy & Cale Hacker Vendor # Oneida Vendor	(920) 737-4520 (920) 737-4520 cell
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CONSTRUCTION & INDUSTRIAL SUPPLIES

Jeta Corporation P,O, Box 336 Neenah, WI 54957-0336 Website: www.jetacorp.com	Linda Grow Vendor # 136888 Oneida Vendor	(920) 486-7072 (920) 486-7078 fax (888) 380-0805
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CONSTRUCTION MANAGEMENT

Green Bay Area Builders 1172 Ashwaubenon Street Green Bay, WI. 54304 E-Mail: natalie@greenbayab.com Web Site: www.greenbayab.com	Natalie Rose Paul Rose Vendor #141472 Oneida Vendor	(920) 632-4309 cell (920) 265-8295 cell (888) 959-6350 fax
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Hues Services Inc. N2632 Huss Court, Freedom, WI 54130 E-Mail: hollysteinbarth@hueservices.com	Holly Steinbarth Vendor # Oneida Vendor HVAC Commercial Only	(920) 809-3631
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Mission Support Services 1033 N. Mayfair Road, Suite 202 Milwaukee, WI. 53226 E-Mail: hcotey@oesccgroup.com Web Site: www.ms2llc.com	Heather Cotey Vendor #144118 Oneida Vendor SBA Certified	(414) 607-6728 (414) 257-2492 fax
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CONSULTANT

Consensus, LLC 1020 Country Club Road Green Bay, WI 54313	Leland & Rebecca Wigg-Ninham Vendor # NONE Oneida Vendor	(920) 499-7810
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JSH Enterprises 1118 Tara Marie Court Green Bay, WI. 54313 E-Mail: jhouse@navigatorpg.com	Jeffrey S. House Vendor # NONE Oneida Vendor	(920) 406-8500 (920) 406-9139 fax
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Oneida Total Integrated Enterprise 2555 Packerland Drive Green Bay, WI. 54313 E-Mail: mkunstman@otie.com Website: www.otiesolutions.com	Matt Kunstman Vendor #134114 Oneida Vendor SBA Certified	(920) 360-6710 cell (920) 884-3970 (920) 884-3989 fax
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RCI Services, LLC P.O. Box 4792 Hilo, Hawaii 96720 E-Mail: rciservicesllc@yahoo.com	Rudolph & Jadeen Webster Vendor # NONE Oneida Vendor	(808) 968-1591 (808) 968-1592 fax (808) 756-6576 cell
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Strateglobe, LLC 112 Riverdale Drive Oneida, WI 54155 E-Mail: jbuckley@strateglobe.com MBE Certified	Joanie Buckley Vendor #126269 Oneida Vendor	(920) 265-4637 cell (920) 482-5808 fax
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Thunderbird Engineering, Inc. 6000 Gisholt Drive Suite 201 Madison, WI. 53713-4816 E-Mail: shawnw@thunderbirdeng.com Website: www.thunderbirdengineering.com	Shawn Woldt & Jim Mickowski Vendor # Indian Vendor	(608) 223-9040 (o) (608) 223-9046 fax (608) 358-9077 cell
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CONSULTANT-COMPUTER PROGRAMING

O-Tech Solutions, LLC 1328 Baumgart Road Green Bay, WI. 54304 E-Mail: cd@o-techsolutions.com Website: www.o-techsolutions.com MBE.8(a), Hub Zone, SDB Certified	Curtis R. Danforth Vendor #129296 Oneida Vendor	(920) 265-2611
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DEMOLITION

Boivin Excavating LLC P.O. Box 1231 Keshena, WI 54135 E-Mail: boivinexcavatingllc@gmail.com	Stewart Boivin Jr. Vendor #141409 Oneida Vendor	(715) 304-9812 (920) 915-1531
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Carl's Trucking W129 Bain Road De Pere, WI. 54115 E-Mail: carltrucking@earthlink.net MBE Certified	Carlton S. Jordan Vendor #130571 Oneida Vendor	(920) 338-1623 (920) 338-1624 fax (920) 621-0512 cell
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D.A.T. Native Pride Trucking LLC N5933 Amanda Way De Pere, WI. 54115 E-Mail: dattrucking01@yahoo.com MBE Certified	Tim Freeman Denise Freeman Vendor # Oneida Vendor	(920) 265-7634 (920) 265-8711
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Jordan Trucking #2 W1965 Pearl Street Seymour, WI. 54165 E-Mail: jordantrucking@hotmail.com Website: www.jordantrucking.2ya.com	Glenn D. Jordan Vendor #127480 Oneida Vendor MBE Certified	(920) 412-5200 (c) (920) 833-7061 fax
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Mission Support Services 1033 N. Mayfair Road, Suite 202 Milwaukee, WI. 53226 E-Mail: hcotey@oescgroup.com Web Site: www.ms2llc.com	Heather Cotey Vendor #144118 Oneida Vendor SBA Certified	(414) 607-6728 (414) 257-2492 fax
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White Buffalo Trucking LLC. W1357 Tall Feather Way Seymour, WI. 54115 E-Mail: ahacker1@new.rr.com DBE Certified	Amy & Cale Hacker Vendor # Oneida Vendor	(920) 737-4520 (920) 737-4520 cell
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DRAFTING SERVICES

Seven Generations Architecture & Engineering, LLC 4664 Campus Drive, Suite 101 Kalamazoo, MI 49008 E-Mail: jberg@7genae.com Web Site: www.7GenAE.com	Jeremy Berg Vendor # Oneida Vendor SBA 8(a) SDB, HUB zone Certified	(269)927-0144 (269)585-2251
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EARTHWORK

Boivin Excavating LLC P.O. Box 1231 Keshena, WI 54135 E-Mail: boivinexcavatingllc@gmail.com	Stewart Boivin Jr. Vendor #141409 Oneida Vendor	(715) 304-9812 (920) 915-1531
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Carl's Trucking W129 Bain Road De Pere, WI. 54115 E-Mail: carltrucking@earthlink.net MBE Certified	Carlton S. Jordan Vendor #130571 Oneida Vendor	(920) 338-1623 (920) 338-1624 fax (920) 621-0512 cell
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D.A.T. Native Pride Trucking LLC N5933 Amanda Way De Pere, WI. 54115 E-Mail: dattrucking01@yahoo.com MBE Certified	Tim Freeman Denise Freeman Vendor # Oneida Vendor	(920) 265-7634 (920) 265-8711
---	--	----------------------------------

Jordan Trucking #2 W1975 Pearl Street Seymour, WI 54165 E-Mail: jordantrucking@hotmail.com Website: www.jordantrucking.2ya.com	Glenn D. Jordan Vendor #106072 Oneida Vendor MBE Certified	(920) 412-5200 (c) (920) 833-7061 fax
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White Buffalo Trucking LLC. W1357 Tall Feather Way Seymour, WI. 54115 E-Mail: ahacker1@new.rr.com DBE Certified	Amy & Cale Hacker Vendor # Oneida Vendor	(920) 737-4520 (920) 737-4520 cell
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ELECTRICIAL

Current Electrical Services 683 Borvan Avenue Suite A Green Bay, WI. 54304 E-Mail: tim@currentelectricalservices.com Website: www.currentelectricalservices.com	Tim Skenandore Vendor # 138363 Oneida Vendor - MBE MBE Certified	(920) 499-3950 (o) (920) 499-3951 fax
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EMBROIDERY

Iroquois Bay 3927 South Iowa Ave. St. Francis, WI. 53235 E-Mail: Michael@iroquoisbay.com	Tammy L. Przytarski Vendor #127480 Oneida Vendor tammy@iroquoisbay.com	(414) 727-2471 (414) 769-9174 fax www.iroquoisbay.com
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ENGINEERING SERVICES

Seven Generations Architecture & Engineering, LLC 4664 Campus Drive, Suite 101 Kalamazoo, MI 49008 E-Mail: jberg@7genae.com Web Site: www.7GenAE.com	Jeremy Berg Vendor # Oneida Vendor SBA 8(a) SDB, HUB zone Certified	(269)927-0144 (269)585-2251
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Oneida Total Integrated Enterprise 2555 Packerland Drive Green Bay, WI. 54313 E-Mail: mkunstman@otie.com Website: www.otiesolutions.com	Matt Kunstman Vendor #134114 SBA Certified	(920) 360-6710 cell (920) 884-3970 (920) 884-3989 fax
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ENVIROMENTAL SERVICES

Oneida Total Integrated Enterprise 2555 Packerland Drive Green Bay, WI. 54313 E-Mail: mkunstman@otie.com Website: www.otiesolutions.com	Matt Kunstman Vendor #134114 Oneida Vendor SBA Certified	(920) 360-6710 cell (920) 884-3970 (920) 884-3989 fax
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EXCAVATION

Boivin Excavating LLC P.O. Box 1231 Keshena, WI 54135 E-Mail: boivinexcavatingllc@gmail.com	Stewart Boivin Jr. Vendor #141409 Oneida Vendor	(715) 304-9812 (920) 915-1531
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Carl's Trucking W129 Bain Road De Pere, WI. 54115 E-Mail: carltrucking@earthlink.net MBE Certified	Carleton S. Jordan Vendor #130571 Oneida Vendor	(920) 338-1623 (920) 338-1624 fax (920) 621-0512 cell
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White Buffalo Trucking LLC. W1357 Tall Feather Way Seymour, WI. 54115 E-Mail: ahacker1@new.rr.com DBE Certified	Amy & Cale Hacker Vendor # Oneida Vendor	(920) 737-4520 (920) 737-4520 cell
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FINANCE

JSH Enterprises 1118 Tara Marie Court Green Bay, WI. 54313 E-Mail: jhouse@navigatorpg.com	Jeffrey S. House Vendor # NONE Oneida Vendor	(920) 406-8500 (920) 406-9139 fax
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FLOORING

Arrow Maintenance, LLC. W805 Daniel Court De Pere, WI. 54115 E-Mail: arrowpavementmaint@yahoo.com	Clyde Skenandore Sr. Clyde Skenandore Jr. Vendor #130016 Oneida Vendor	(920) 371-3635 (920) 869-1826 fax
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Mavid Construction Services, LLC. 1609 Western Avenue, Suite A Green Bay, WI. 54303 Email: Zoar@mavidconstruction.com	Zoar Fulwilder David Montiel Edward Martin Vendor # NONE Indian Vendor	(920) 965-0271 (o) (888) 494-0504 fax (920) 655-6023 cell
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FLOWERS

Flower Co. 2565 Riverview Drive, Suite A Green Bay, WI. 54313 E-Mail: douglas@flowerco.biz Website: www.flowerco.biz	Douglas Schmidt Vendor # 138018 Oneida Vendor	(920) 434-9461
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Roots on 9 th 1369 9 th Street Green Bay, WI. 54304 E-Mail: Jamie@rootsgb.com Website: www.rootsgb.com	Jamie Hemenway-Peotter Vendor # Oneida Vendor	(920) 634-2788 (920) 246-1745 Cell
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FOOD SERVICE

Blue Harbor Fish & Sea 1112 N. McDonald Street Green Bay, WI. 54313 E-Mail: blueharborfish@yahoo.com MBE Certified	Lori A. Parkinson Vendor #126559 Indian Vendor	(920) 435-4633 (O) (920) 635-8205 fax (920) 264-7082 cell
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WT Creations/Sister Bread 2425 O'Connor Road Green Bay, WI. 54313 E-Mail: ccharle1@oneidanation.org	Corina Charles Vendor #109236 Oneida Vendor	(920) 869.1370 (920) 713-6793 cell
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GAMING EQUIPMENT/UNIFORMS

Gitchi Games, Inc. P.O. Box 335 Prescott, WI 54021 E-Mail: gjohn@gitchigaming.com Website: www.gitchigaming.com	Gregory B. Johns Vendor #105692 Oneida Vendor MBE Certified	(715) 262-8899 (715) 262-3447 fax
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GENERAL CONTRACTOR

Green Bay Area Builders 1172 Ashwaubenon Street Green Bay, WI. 54304 E-Mail: natalie@greenbayab.com Web Site: www.greenbayab.com	Natalie Rose Paul Rose Vendor #141472 Oneida Vendor	(920) 632-4309 cell (920) 265-8295 cell (888) 959-6350 fax
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Mission Support Services 1033 N. Mayfair Road, Suite 202 Milwaukee, WI. 53226 E-Mail: hcotey@oesgroup.com Web Site: www.ms2llc.com	Heather Cotey Vendor #144118 Oneida Vendor SBA Certified	(414) 607-6728 (414) 257-2492 fax
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INSURANCE

JSH Enterprise 1118 Tara Marie Court Green Bay, WI 54313 E-Mail: jhouse@naviatorpg.com	Jeffrey S. House Vendor # NONE Oneida Vendor	(920) 406-8500 (920) 406-9139 fax (920) 606-6690 cell
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INTERIOR DESIGN

Seven Generations Architecture & Engineering, LLC 4664 Campus Drive, Suite 101 Kalamazoo, MI 49008 E-Mail: jberg@7genae.com Web Site: www.7GenAE.com	Jeremy Berg Vendor # Oneida Vendor SBA 8(a) SDB, HUB zone Certified	(269)927-0144 (269)585-2251
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INTER-TRIBAL DEPARTMENTS & ENTERPRISES

Anna John Resident Centered Care 2901 S. Overland Road Oneida, WI 54155 E-Mail: nfeldkam@oneidanation.org	Nola Feldkamp Vendor #100762 Oneida Vendor	(920) 869-2797 (920) 869-3238 fax
Anna John Resident Centered Care	Nola Feldkamp	(920) 869-2797

Bay Bank Packerland Drive Green Bay, WI 54313 Website: www.baybankgb.com	Jeff Bowman Vendor # NONE Oneida Vendor	(920) 490-7600 (920) 490-0930 fax
Bay Bank	Jeff Bowman	(920) 490-7600

Department of Public Works (Plumbing) W1278 Ranch Road Oneida, WI 54155 E-Mail: djohnso2@oneidanation.org	Dennis Johnson Vendor #105007 Oneida Vendor	(920) 869-1059 (930) 869-1559 fax (920) 713-8065 cell
Department of Public Works (Plumbing)	Dennis Johnson	(920) 869-1059

Mission Support Services 1033 N. Mayfair Road, Suite 202 Milwaukee, WI. 53226 E-Mail: hcotey@oescgroup.com Web Site: www.ms2llc.com	Heather Cotey Vendor #144118 Oneida Vendor SBA Certified	(414) 607-6728 (414) 257-2492fax
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Oneida Community Cannery (Tsi?Kute K) N7210 Seminary Road Oneida, WI 54155 E-Mail: vcornelius@oneidanation.org	Vicki Cornelius Vendor # NONE Oneida Vendor	(920) 869-4579 (920) 869-1059fax
Oneida Community Cannery (Tsi?Kute K)	Vicki Cornelius	(920) 869-4379

Oneida Nation Agricultural Center (Farm & Orchard)		(920) 833-7952
N6010 County Road C	Vendor #100078	(920) 833-2559 fax
Seymour, WI. 54155	Oneida Vendor	
E-Mail: farm@oneidanation.org		
Oneida Nation Agri Center (Farm & Orchard)		(920) 833-7952

Oneida Nation Wardrobe Department	Wanda Diemel	(920) 494.4500
2170 Airport Rd	Vendor #	(920)429.3444
Green Bay, WI 54313	Oneida Vendor	

Oneida Printing Enterprises	Michelle Danforth-Anderson	(920) 496-5624
PO Box 365	Vendor #100807	
Green Bay, WI 54303	Oneida Vendor	
E-Mail: MDANFOR8@oneidanation.org		
MBE Certified		

Oneida Total Integrated Enterprise	Matt Kunstman	(920) 360-6710 cell
2555 Packerland Drive	Vendor #134114	(920) 884-3970
Green Bay, WI. 54313		(920) 884-3989 fax
E-Mail: mkunstman@otie.com		
Website: www.otiesolutions.com	SBA Certified	

Radisson Hotel & Conference Center	Oneida Airport Hotel Corp.	(920) 494-7300
2040 Airport Drive	Vendor #100047	(920) 494-9599 fax
Green Bay, WI. 54311	Oneida Vendor	
Website: www.radisson.com/greenbaywi		
Radisson Hotel & Conference Center	Oneida Airport Hotel Corp.	(920) 494-7300

Wingate by Wyndham Green Bay	Oneida Airport Hotel Corp.	(920) 617-2000
2065 Airport Drive	Vendor #122788	(920) 617-2001 fax
Green Bay, WI. 54311	Oneida Vendor	
Website: www.wingatehotels.com/greenbaywi		

LANDSCAPE & LAWN CUTTING

Carl's Trucking	Carleton S. Jordan	(920) 338-1623
W129 Bain Road	Vendor #130571	(920) 338-1624 fax
De Pere, WI. 54115	Oneida Vendor	(920) 621-0512 cell
E-Mail: carltrucking@earthlink.net		
MBE Certified		

Roots on 9 th	Jamie Hemenway-Peotter	(920) 634-2788
1369 9 th Street	Vendor #	(920) 246-1745Cell
Green Bay, WI. 54304	Oneida Vendor	
E-Mail: Jamie@rootsgb.com		
Website: www.rootsgb.com		

MECHANICAL CONTRACTOR (HVAC)

KHMI, LLC	Phillip L. King, Jr.	(920) 370-3606
P.O. BOX 12738	Vendor #137698	
Green Bay, WI 54307-2738	Oneida Vendor	
E-Mail: philking@k-hmi.com		

TGHS, LLC 325 Reid Street Depere, WI. 54115-5211 E-Mail: Hollysteinbarth@huesservices.com	Holly Steinbarth Vendor # Oneida Vendor	(920) 809-3631
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MEDIA

HVS Advertising-Marketing 2021 S. Webster Avenue Green Bay, WI. 54301-0723 E-Mail: Ron@hvsproductions.com MBE Certified	Ronald Peterson Vendor #106885 Oneida Vendor	(920) 430-5131 (920) 430-5126 fax
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NATIVE ART

Thundercloud Native American Art 1412 Chief Hill Drive Green Bay, WI. 54313 E-Mail: smwolf2004@yahoo.com	JoAnne Thundercloud Vendor #133369 Oneida Vendor	(920) 785-1790
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PAINTING

Go-Green Painting, LLC 1440 Acorn Drive Green Bay, WI 54304 E-mail Address: gogreenpainting@new.rr.com Website: www.go-greenpainting.com	Allen Danforth Vendor # NONE Oneida Vendor	(920) 366-0778 Office & Cell
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Great Lakes Painting 521 Arlington Street Algoma, WI 54201 E-mail: wierichs@charter.net Website: www.great-lakes-painting.com	Donald Wierichs Vendor #134603 Oneida Vendor	(920) 487-2916 (920) 487-3868 fax
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PHOTOGRAPHER

D. King of Images, LLC N6944 Cornelius Circle Oneida, WI. 54155 E-Mail: dking4@new.rr.com Website: www.dkingofimages.com	Dennis D. King Vendor #133675 Oneida Vendor	(920) 869-5464 (920) 606-5464
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PLUMBING

Department of Public Works (Plumbing) W1278 Ranch Road Oneida, WI. 54155 E-Mail: kdanfor1@oneidanation.org	Kerry Danforth Vendor #105007 Oneida Vendor	(920) 869-1059 (930) 869-1559 fax (920) 713-8644 cell
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PRESSURE WASH CLEANING – Industrial/Commercial/Residential

Green Bay Pressure Cleaning 1827 Plane Park Drive De Pere, WI 54155 E-Mail: zablockibz@gmail.com Website: www.greenbaypressurecleaning.com	Brian J. Zablocki Vendor # NONE Oneida Vendor	920.468.7123 Cell:920-819-0620
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PRINT BROKER / PRINT SUPPLIES

True North Resources, LLC. 4946 Woodlawn Pl. Milwaukee, WI. 53228 E-Mail: kathrynt@truenorth-resources.com	Kathryn Turenske Vendor # 130913 Oneida Vendor	(414) 460-4909 (O) (414) 529-1013 fax
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PRINT SHOP

Oneida Printing Enterprises PO Box 365 Green Bay, WI 54303 E-Mail: MDANFOR8@oneidanation.org MBE Certified	Michelle Danforth-Anderson Vendor #100807 Oneida Vendor	(920) 496-5624
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RETAIL

Menominee Tribal Enterprises PO Box 10 Neopit, WI. 54135	Adrian Miller Vendor # 101288 Indian Vendor	(715) 756-2311 (715) 756-2386 fax
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SAND SALES & GRAVEL

Carl's Trucking W129 Bain Road De Pere, WI. 54115 E-Mail: carltrucking@earthlink.net MBE Certified	Carleton S. Jordan Vendor #130571 Oneida Vendor	(920) 338-1623 (920) 338-1624 fax (920) 621-0512 cell
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SAFETY CONSULTING

Mission Support Services 1033 N. Mayfair Road, Suite 202 Milwaukee, WI. 53226 E-Mail: hcotey@oescgroup.com Web Site: www.ms2llc.com	Heather Cotey Vendor #144118 Oneida Vendor SBA Certified	(414) 607-6728 (414) 257-2492 fax
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SNOWPLOWING, RESIDENTIAL/COMMERCIAL

Carl's Trucking W129 Bain Road De Pere, WI. 54115 E-Mail: carltrucking@earthlink.net MBE Certified	Carleton S. Jordan Vendor #130571 Oneida Vendor	(920) 338-1623 (920) 338-1624 fax (920) 621-0512 cell
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Integrity Towing LLC 5910 Old HWY 29 Road Oneida, WI. 54155 E-Mail: j.johnsonccc@yahoo.com Snow Plow Installation & Repair	Joseph K Johnson Vendor #NONE Oneida Vendor	(920) 366-2235 cell (920) 869-2255
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White Buffalo Trucking LLC. W1357 Tall Feather Way Seymour, WI. 54115 E-Mail: ahacker1@new.rr.com DBE Certified	Amy & Cale Hacker Vendor # Oneida Vendor	(920) 737-4520 (920) 737-4520 cell
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TELECOMMUNICATIONS

O-Tech Solutions, LLC 1328 Baumgart Road Green Bay, WI. 54304 E-Mail: cd@o-techsolutions.com Website: www.o-techsolutions.com MBE.8(a), Hub Zone, SDB Certified	Curtis R. Danforth Vendor #129296 Oneida Vendor	(920) 265-2611
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TELEPHONE/POLLING SERVICES

RCI Services, LLC P.O. Box 4792 Hilo, Hawaii 96720 E-Mail: rciservicesllc@yahoo.com	Rudolph & Jadeen Webster Vendor # NONE Oneida Vendor	(808) 968-1591 (808) 968-1592 fax (808) 756-6576 cell
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TRUCKING

Carl's Trucking W129 Bain Road De Pere, WI. 54115 E-Mail: carltrucking@earthlink.net MBE Certified	Carleton S. Jordan Vendor #130571 Oneida Vendor	(920) 338-1623 (920) 338-1624 fax (920) 621-0512 cell
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D.A.T. Native Pride Trucking LLC N5933 Amanda Way De Pere, WI. 54115 E-Mail: dattrucking01@yahoo.com MBE Certified	Tim Freeman Denise Freeman Vendor # Oneida Vendor	(920) 265-7634 (920) 265-8711
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Jordan Trucking #2 W1965 Pearl Street Seymour, WI. 54165 E-Mail: jordantrucking@hotmail.com Website: www.jordantrucking.2ya.com	Glenn D. Jordan Vendor # 127480 Oneida Vendor MBE Certified	(920) 412-5200 (c) (920) 833-7061 fax
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White Buffalo Trucking LLC. W1357 Tall Feather Way Seymour, WI. 54115 E-Mail: ahacker1@new.rr.com DBE Certified	Amy & Cale Hacker Vendor # Oneida Vendor	(920) 737-4520 (920) 737-4520 cell
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Document 00 31 43 – PERMIT FEE SCHEDULE

1. GENERAL

1.1. PERMITS

- A. Permits are required for this project. All required building and other permits shall be obtained by the Contractor before beginning construction.
- B. All applicable building and other permits shall be obtained by the Contractor from the following.
 - 1. Permits for Work within the property boundaries shall be obtained from the Oneida Zoning Department.
 - 2. Permits for Work outside of the property boundaries shall be obtained from the municipality having jurisdiction.
- C. For questions regarding the Oneida Zoning Department Permit Fee Schedule, please contact:

Leanne Doxtater – Zoning Administrator
N7332 Water Circle Place
Oneida, WI 54155
PH: 920-869-4534
FAX: 920-869-1610
ldoxtate@oneidanation.org

END OF 00 31 43 – PERMIT FEE SCHEDULE

ONEIDA ZONING DEPARTMENT – PERMIT FEE SCHEDULE FOLLOWS

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From: [Bridget E. John](#)
To: [Paul J. Witek](#)
Subject: RE: Utility Dept. Fees
Date: Thursday, August 31, 2017 3:33:23 PM

Hi Paul,
I just have this:

Additional charges
3% Late Fee for All Sewer/Water/Septic/Refuse
\$50.00 Disconnection Fee (includes Reconnection)

\$5.00 charge for certified letters to past due accounts
\$125.00 Meter Tampering
Fee

\$300.00 Sewer hookup Permit
\$300.00 Water hookup Permit
\$15.00 for Garnishment/Collection action Fee
\$250.00 Illegal Connection
Fee
Delinquent Bin Pick up fee \$75.00
Construction Water use \$125.00 plus cost per thousand Gallons usage
Fine for taking water without permission \$500.00

Bridget E John
Accounting Supervisor
Oneida Nation Utilities Department
PO Box 365
Oneida, WI 54155
Phone: 920-496-5291
Fax: 920-497-5811
bjohn@oneidanation.org



A Good Mind. A Good Heart. A Strong Fire.

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ONEIDA ZONING DEPARTMENT PERMIT FEE SCHEDULE

Adopted By Oneida Business Committee Resolution – March 13, 2013

Residential / UDC / R1, R2

SPS 320 - 325

General Construction *	\$ 25.00
Electrical	\$ 25.00
Plumbing	\$ 25.00
HVAC	\$ 25.00
Fire Suppression System	\$ 25.00
Land Use	\$ 25.00 (Oneida Law 69.10-1)

Permits Not Required for Replacement of non-structural items (following are examples), A permit taken out for work under this section has no fees attached.

Windows	Flooring
Soffit / Fascia	Driveway
Siding	Toilets / Sinks
Re shingling roof	Concrete Patios
Water Heater	

Emergency Furnace Replacement

Furnace is installed
Contractor reports installation to Oneida Zoning
Contractor submits affidavit to Oneida Zoning (Emergency Furnace Affidavit)
\$25.00 payment (HVAC FEE)

PUD (Oneida Law 69.9)

Filing Fee	\$500.00
Deposit	**

Razing Permit (Oneida Law 66.20)

R-1	\$25.00
Agriculture	\$75.00
Commercial	\$200.00

* Includes Pools, Fences, Accessory Buildings

** As determined by the Zoning Administrator on a project by project basis

Commercial / IBC

SPS 360 – 366

Plan Review

.08 sq. ft. \$75.00 min

General Construction*

.08 sq. ft. \$250.00 min

Electrical .04 sq. ft. \$250.00 min

Plumbing / Fire Suppression .04 sq. ft. \$250.00 min

HVAC .04 sq. ft. \$250.00 min

Note: Sq. Ft. is calculated on total floor area.

Land Use

Seasonal Lawn and Garden \$100.00

≤ 1 acre \$200.00 (1 acre or less)

>1 acre \$500.00 (Greater than 1 acre)

Temporary Structures **

≤400 sq ft \$100.00

>400 sq ft Case by Case ***

Plan Review / Commercial (allow 2 weeks)

Required Documentation

- Full Set of Construction Documents (to include all trades / disciplines)
- Project Manual
- Copy of State Submittal Application
- Copy of State Review Approval Letter (when received)
- Project Data
- Applicable Codes
- Associated Calculations

* Includes storm water, erosion control

** Less than 400 SF and less than 184 days (tents, canopies)

*** Special Outdoor Events / Examples (Pow Wow, Apple Fest / NFPA1 10.15)

Sanitary / Private Onsite Waste Treatment System (POWTS)

SPS 383

R-1 (one and two family dwelling)

New	\$100
Existing *	\$100
Holding Tanks	\$150

Commercial

New	\$400
Existing *	\$400
Holding Tank	\$500

* Replacement, modify, repair to more than two components

Additional fees charged by other programs

1. Utility connection fees, tribal system – Oneida Utilities Department
2. Non-tribal systems – appropriate Authority Having Jurisdiction.
3. Storm Water fees – Oneida Environmental Department, (this fee is in addition to Land Use Permit fees paid to the Zoning Department).

Signs

Oneida Law 69.11

FEES

\$25.00

Wall Banner < 48 sf < 90 days
Comm, Industrial, Institutional, Agriculture Districts

Wall Sign < 50 sf < 30' high
Comm, Industrial, Institutional, Agriculture Districts

Seasonal Business Sign < 32 sf < 30 days
Comm, Industrial, Institutional, Agriculture Districts

Mobile Mounted Sign < 48 sf < 90 days < 8' high
Comm, Industrial Districts

Free Standing Sign < 10 sf per side
Comm, Industrial, Institutional, Agriculture Districts
2 side limit

Window Signs < 25% of window pane

\$50.00

Electric Message Center < 150 sf per side
Comm, Industrial, Institutional, Agriculture Districts
2 side limit

Ground Signs < 250 sf per side < 50' high
Comm, Industrial, Institutional, Agriculture Districts
2 side limit

\$500.00

Billboards < 300 sf
≤ 300 sf
≥ 301 – 700 (Requires a Conditional Use Permit)

DOCUMENT 004113 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.1 BID INFORMATION

- A. Bidder: _____.
- B. Project Name: Elder Services/Apartment Improvements.
- C. Project Location: 2907 S. Overland Dr. Oneida, Wisconsin 54155.
- D. Owner: Oneida Nation.
- E. Owner Project Number: 05-013.
- F. Architect: Oneida Total Integrated Enterprises (OTIE).
- G. Architect Project Number: 2018085.

1.2 CERTIFICATIONS AND BASE BID

- A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by OTIE and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:
 - 1. _____ Dollars (\$_____).
 - 2. The above amount may be modified by amounts indicated by the Bidder on the attached Document 004322 "Unit Prices Form" and Document 004323 "Alternates Form."
 - 3. Cost to add P&P Bonds to Base Bid (\$_____)

1.3 BID GUARANTEE

- A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within **10** days after a written Notice of Award, if offered within **60** days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:
 - 1. _____ Dollars (\$_____).
- B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 SUBCONTRACTORS AND SUPPLIERS

A. The following companies shall execute subcontracts for the portions of the Work indicated:

1. Concrete Work: _____.
2. Masonry Work: _____.
3. Roofing Work: _____.
4. Plumbing Work: _____.
5. HVAC Work: _____.
6. Electrical Work: _____.
7. Carpentry/Framing Work: _____.
8. Painting Work: _____.
9. Fire Protection: _____.
10. Earthwork/Excavation Work: _____.

1.5 TIME OF COMPLETION

- A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Owner, and shall fully complete the Work within 154 calendar days.
- B. If the undersigned Bidder foresees the proposed duration is not feasible, the undersigned bidder proposes to complete the work within _____ calendar days.

1.6 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.

1.7 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto.

1. Bid Form Supplement - Alternates.
2. Bid Form Supplement - Unit Prices.
3. Bid Form Supplement - Bid Bond Form (AIA Document A310).

1.8 SUBMISSION OF BID

A. Respectfully submitted this ____ day of _____, 2019.

B. Submitted By: _____ (Name of bidding firm or corporation).

- C. Authorized Signature: _____ (Handwritten signature).
- D. Signed By: _____ (Type or print name).
- E. Title: _____ (Owner/Partner/President/Vice President).
- F. Witness By: _____ (Handwritten signature).
- G. Attest: _____ (Handwritten signature).
- H. By: _____ (Type or print name).
- I. Title: _____ (Corporate Secretary or Assistant Secretary).
- J. Street Address: _____.
- K. City, State, Zip: _____.
- L. Phone: _____.
- M. E-mail: _____.
- N. Federal ID No.: _____ (Affix Corporate Seal Here).

END OF DOCUMENT 004113

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DOCUMENT 004322 - UNIT PRICES FORM

1.1 BID INFORMATION

- A. Bidder: _____.
- A. Project Name: Elder Services/Apartment Improvements.
- B. Project Location: 2907 S. Overland Dr. Oneida, Wisconsin 54155.
- C. Owner: Oneida Nation.
- D. Owner Project Number: 05-013.
- E. Architect: Oneida Total Integrated Enterprises (OTIE).
- F. Architect Project Number: 2018085.

1.2 BID FORM SUPPLEMENT

- A. This form is required to be attached to the Bid Form.
- B. The undersigned Bidder proposes the amounts below be added to or deducted from the Contract Sum on performance and measurement of the individual items of Work and for adjustment of the quantity given in the Unit-Price Allowance for the actual measurement of individual items of the Work.
- C. If the unit price does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."

1.3 UNIT PRICES

- A. Unit-Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.
 - 1. _____ Dollars (\$ _____) per unit.
- B. Unit-Price No. 2: Rock excavation and replacement with satisfactory soil material.
 - 1. _____ Dollars (\$ _____) per unit.
- C. Unit-Price No. 3: Cutting and patching of concrete floor slabs.
 - 1. _____ Dollars (\$ _____) per unit.
- D. Unit-Price No. 4: Miscellaneous and structural steel.
 - 1. _____ Dollars (\$ _____) per unit.

1.4 SUBMISSION OF BID SUPPLEMENT

- A. Respectfully submitted this ____ day of _____, 2012.
- B. Submitted By: _____ (Insert name of bidding firm or corporation).
- C. Authorized Signature: _____ (Handwritten signature).
- D. Signed By: _____ (Type or print name).
- E. Title: _____ (Owner/Partner/President/Vice President).

END OF DOCUMENT 004322

DOCUMENT 004323 - ALTERNATES FORM

1.1 BID INFORMATION

- A. Bidder: _____.
- B. Prime Contract: _____.
- C. Project Name: Elder Services/Apartment Improvements.
- D. Project Location: 2907 S. Overland Dr. Oneida, Wisconsin 54155.
- E. Owner: Oneida Nation.
- F. Owner Project Number: 05-013.
- G. Architect: Oneida Total Integrated Enterprises (OTIE).
- H. Architect Project Number: 2018085.

1.2 BID FORM SUPPLEMENT

- A. This form is required to be attached to the Bid Form.

1.3 DESCRIPTION

- A. The undersigned Bidder proposes the amount below be added to or deducted from the Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.
 - 1. Cost-Plus-Fee Contract: Alternate price given below includes adjustment to Contractor's Fee.
- B. If the alternate does not affect the Contract Sum, the Bidder shall indicate "NO CHANGE."
- C. If the alternate does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."
- D. The Bidder shall be responsible for determining from the Contract Documents the affects of each alternate on the Contract Time and the Contract Sum.
- E. Owner reserves the right to accept or reject any alternate, in any order, and to award or amend the Contract accordingly within 60 days of the Notice of Award unless otherwise indicated in the Contract Documents.
- F. Acceptance or non-acceptance of any alternates by the Owner shall have no affect on the Contract Time unless the "Schedule of Alternates" Article below provides a formatted space for the adjustment of the Contract Time.

1.4 SCHEDULE OF ALTERNATES

A. Alternate No.:

1. ADD ____ DEDUCT ____ NO CHANGE ____ NOT APPLICABLE ____.
2. _____ Dollars (\$_____).
3. ADD ____ DEDUCT ____ calendar days to adjust the Contract Time for this alternate.

1.5 SUBMISSION OF BID SUPPLEMENT

- A. Respectfully submitted this ____ day of _____, 2012.
- B. Submitted By: _____ (Insert name of bidding firm or corporation).
- C. Authorized Signature: _____ (Handwritten signature).
- D. Signed By: _____ (Type or print name).
- E. Title: _____ (Owner/Partner/President/Vice President).

END OF DOCUMENT 004323

DOCUMENT 006000 - PROJECT FORMS

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

- A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:
 - 1. AIA Document A105-2017, "Standard Short Form of Agreement between Owner and Contractor."

END OF DOCUMENT 006000

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AIA[®] Document A105[™] – 2017

Standard Short Form of Agreement Between Owner and Contractor

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)

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

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

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

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

The Owner and Contractor agree as follows.

TABLE OF ARTICLES

1	THE CONTRACT DOCUMENTS
2	DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
3	CONTRACT SUM
4	PAYMENTS
5	INSURANCE
6	GENERAL PROVISIONS
7	OWNER
8	CONTRACTOR
9	ARCHITECT
10	CHANGES IN THE WORK
11	TIME
12	PAYMENTS AND COMPLETION
13	PROTECTION OF PERSONS AND PROPERTY
14	CORRECTION OF WORK
15	MISCELLANEOUS PROVISIONS
16	TERMINATION OF THE CONTRACT
17	OTHER TERMS AND CONDITIONS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contractor shall complete the Work described in the Contract Documents for the Project. The Contract Documents consist of

- .1 this Agreement signed by the Owner and Contractor;
- .2 the drawings and specifications prepared by the Architect, dated _____, and enumerated as follows:

Drawings:

Number

Title

Date

Specifications:

Section

Title

Pages

.3 addenda prepared by the Architect as follows:

Number

Date

Pages

.4 written orders for changes in the Work, pursuant to Article 10, issued after execution of this Agreement;
and

.5 other documents, if any, identified as follows:

ARTICLE 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 2.1 The Contract Time is the number of calendar days available to the Contractor to substantially complete the Work.

§ 2.2 Date of Commencement:

Unless otherwise set forth below, the date of commencement shall be the date of this Agreement.
(Insert the date of commencement if other than the date of this Agreement.)

§ 2.3 Substantial Completion:

Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion, as defined in Section 12.5, of the entire Work:
(Check the appropriate box and complete the necessary information.)

☐ Not later than () calendar days from the date of commencement.

☐ By the following date:

ARTICLE 3 CONTRACT SUM

§ 3.1 The Contract Sum shall include all items and services necessary for the proper execution and completion of the Work. Subject to additions and deductions in accordance with Article 10, the Contract Sum is: (\$)

§ 3.2 For purposes of payment, the Contract Sum includes the following values related to portions of the Work:
(Itemize the Contract Sum among the major portions of the Work.)

Portion of the Work

Value

§ 3.3 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and hereby accepted by the Owner:

(Identify the accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

§ 3.4 Allowances, if any, included in the Contract Sum are as follows:
(Identify each allowance.)

Item	Price
------	-------

§ 3.5 Unit prices, if any, are as follows:
(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)
------	-----------------------	-------------------------

ARTICLE 4 PAYMENTS

§ 4.1 Based on Contractor's Applications for Payment certified by the Architect, the Owner shall pay the Contractor, in accordance with Article 12, as follows:
(Insert below timing for payments and provisions for withholding retainage, if any.)

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

%

ARTICLE 5 INSURANCE

§ 5.1 The Contractor shall maintain the following types and limits of insurance until the expiration of the period for correction of Work as set forth in Section 14.2, subject to the terms and conditions set forth in this Section 5.1:

§ 5.1.1 Commercial General Liability insurance for the Project, written on an occurrence form, with policy limits of not less than (\$) each occurrence, (\$) general aggregate, and (\$) aggregate for products-completed operations hazard.

§ 5.1.2 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than (\$) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance, and use of those motor vehicles along with any other statutorily required automobile coverage.

§ 5.1.3 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided that such primary and excess or umbrella insurance policies result in the same or greater coverage as those required under Section 5.1.1 and 5.1.2, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ 5.1.4 Workers' Compensation at statutory limits.

§ 5.1.5 Employers' Liability with policy limits not less than (\$) each accident, (\$) each employee, and (\$) policy limit.

§ 5.1.6 The Contractor shall provide builder's risk insurance to cover the total value of the entire Project on a replacement cost basis.

§ 5.1.7 Other Insurance Provided by the Contractor

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage

Limits

§ 5.2 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance and shall provide property insurance to cover the value of the Owner's property. The Contractor is entitled to receive an increase in the Contract Sum equal to the insurance proceeds related to a loss for damage to the Work covered by the Owner's property insurance.

§ 5.3 The Contractor shall obtain an endorsement to its Commercial General Liability insurance policy to provide coverage for the Contractor's obligations under Section 8.12.

§ 5.4 Prior to commencement of the Work, each party shall provide certificates of insurance showing their respective coverages.

§ 5.5 Unless specifically precluded by the Owner's property insurance policy, the Owner and Contractor waive all rights against (1) each other and any of their subcontractors, suppliers, agents, and employees, each of the other; and (2) the Architect, Architect's consultants, and any of their agents and employees, for damages caused by fire or other causes of loss to the extent those losses are covered by property insurance or other insurance applicable to the Project, except such rights as they have to the proceeds of such insurance.

ARTICLE 6 GENERAL PROVISIONS

§ 6.1 The Contract

The Contract represents the entire and integrated agreement between the parties and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a written modification in accordance with Article 10.

§ 6.2 The Work

The term "Work" means the construction and services required by the Contract Documents, and includes all other labor, materials, equipment, and services provided, or to be provided, by the Contractor to fulfill the Contractor's obligations.

§ 6.3 Intent

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.

§ 6.4 Ownership and Use of Architect's Drawings, Specifications and Other Documents

Documents prepared by the Architect are instruments of the Architect's service for use solely with respect to this Project. The Architect shall retain all common law, statutory, and other reserved rights, including the copyright. The Contractor, subcontractors, sub-subcontractors, and suppliers are authorized to use and reproduce the instruments of service solely and exclusively for execution of the Work. The instruments of service may not be used for other Projects or for additions to this Project outside the scope of the Work without the specific written consent of the Architect.

§ 6.5 Electronic Notice

Written notice under this Agreement may be given by one party to the other by email as set forth below.

(Insert requirements for delivering written notice by email 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.)

ARTICLE 7 OWNER

§ 7.1 Information and Services Required of the Owner

§ 7.1.1 If requested by the Contractor, the Owner shall furnish all necessary surveys and a legal description of the site.

§ 7.1.2 Except for permits and fees under Section 8.7.1 that are the responsibility of the Contractor, the Owner shall obtain and pay for other necessary approvals, easements, assessments, and charges.

§ 7.1.3 Prior to commencement of the Work, at the written request of 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.

§ 7.2 Owner's Right to Stop the Work

If the Contractor fails to correct Work which is not in accordance with the Contract Documents, the Owner may direct the Contractor in writing to stop the Work until the correction is made.

§ 7.3 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 seven day period after receipt of written 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, correct such deficiencies. In such case, the Architect may withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the cost of correction, provided the actions of the Owner and amounts charged to the Contractor were approved by the Architect.

§ 7.4 Owner's Right to Perform Construction and to Award Separate Contracts

§ 7.4.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project.

§ 7.4.2 The Contractor shall coordinate and cooperate with the Owner's own forces and separate contractors employed by the Owner.

ARTICLE 8 CONTRACTOR

§ 8.1 Review of Contract Documents and Field Conditions by Contractor

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

§ 8.1.2 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner. Before commencing activities, the Contractor shall (1) take field measurements and verify field conditions; (2) carefully compare this and other information known to the Contractor with the Contract Documents; and (3) promptly report errors, inconsistencies, or omissions discovered to the Architect.

§ 8.2 Contractor's Construction Schedule

The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work.

§ 8.3 Supervision and Construction Procedures

§ 8.3.1 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.

§ 8.3.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner, through the Architect, the names of subcontractors or suppliers for each portion of the Work. The Contractor shall not contract with any subcontractor or supplier to whom the Owner or Architect have made a timely and reasonable objection.

§ 8.4 Labor and Materials

§ 8.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work.

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

§ 8.5 Warranty

The Contractor warrants to the Owner and Architect that: (1) materials and equipment furnished under the Contract will be new and of good quality unless otherwise required or permitted by the Contract Documents; (2) the Work will be free from defects not inherent in the quality required or permitted; and (3) the Work will conform to the requirements of the Contract Documents. Any material or equipment 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 12.5.

§ 8.6 Taxes

The Contractor shall pay sales, consumer, use, and similar taxes that are legally required when the Contract is executed.

§ 8.7 Permits, Fees and Notices

§ 8.7.1 The Contractor shall obtain and pay for the building permit and other permits and governmental fees, licenses, and inspections necessary for proper execution and completion of the Work.

§ 8.7.2 The Contractor shall comply with and give notices required by agencies having jurisdiction over the Work. 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 full responsibility for such Work and shall bear the attributable costs. The Contractor shall promptly notify the Architect in writing of any known inconsistencies in the Contract Documents with such governmental laws, rules, and regulations.

§ 8.8 Submittals

The Contractor shall promptly review, approve in writing, and submit to the Architect shop drawings, product data, samples, and similar submittals required by the Contract Documents. Shop drawings, product data, samples, and similar submittals are not Contract Documents.

§ 8.9 Use of Site

The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits, the Contract Documents, and the Owner.

§ 8.10 Cutting and Patching

The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly.

§ 8.11 Cleaning Up

The Contractor shall keep the premises and surrounding area free from accumulation of debris and trash related to the Work. At the completion of the Work, the Contractor shall remove its tools, construction equipment, machinery, and surplus material; and shall properly dispose of waste materials.

§ 8.12 Indemnification

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.

ARTICLE 9 ARCHITECT

§ 9.1 The Architect will provide administration of the Contract as described in the Contract Documents. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 9.2 The Architect will visit the site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the Work.

§ 9.3 The Architect will not have control over or charge of, and will not be responsible for, construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility. The Architect will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents.

§ 9.4 Based on the Architect's observations and evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor.

§ 9.5 The Architect has authority to reject Work that does not conform to the Contract Documents.

§ 9.6 The Architect will promptly review and approve or take appropriate action upon Contractor's submittals, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 9.7 On written request from either the Owner or Contractor, the Architect will promptly interpret and decide matters concerning performance under, and requirements of, the Contract Documents.

§ 9.8 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from the Contract Documents, and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 9.9 The Architect's duties, responsibilities, and limits of authority as described in the Contract Documents shall not be changed without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

ARTICLE 10 CHANGES IN THE WORK

§ 10.1 The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract, consisting of additions, deletions or other revisions, and the Contract Sum and Contract Time shall be adjusted accordingly, in writing. If the Owner and Contractor cannot agree to a change in the Contract Sum, the Owner shall pay the Contractor its actual cost plus reasonable overhead and profit.

§ 10.2 The Architect may authorize or 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. Such authorization or order shall be in writing and shall be binding on the Owner and Contractor. The Contractor shall proceed with such minor changes promptly.

§ 10.3 If concealed or unknown physical conditions are encountered at the site that differ materially from those indicated in the Contract Documents or from those conditions ordinarily found to exist, the Contract Sum and Contract Time shall be subject to equitable adjustment.

ARTICLE 11 TIME

§ 11.1 Time limits stated in the Contract Documents are of the essence of the Contract.

§ 11.2 If the Contractor is delayed at any time in progress of the Work by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, or other causes beyond the Contractor's control, the Contract Time shall be subject to equitable adjustment.

§ 11.3 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the responsible party.

ARTICLE 12 PAYMENTS AND COMPLETION

§ 12.1 Contract Sum

The Contract Sum stated in this Agreement, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 12.2 Applications for Payment

§ 12.2.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for Work completed in accordance with the values stated in this Agreement. The Application shall be supported by data substantiating the Contractor's right to payment as the Owner or Architect may reasonably require, such as evidence of payments made to, and waivers of liens from, subcontractors and suppliers. 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 stored, and protected from damage, off the site at a location agreed upon in writing.

§ 12.2.2 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 other encumbrances adverse to the Owner's interests.

§ 12.3 Certificates for Payment

The Architect will, within seven 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; (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 in writing of the Architect's reasons for withholding certification in part; 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. If certification or notification is not made within such seven day period, the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time and the Contract Sum shall be equitably adjusted due to the delay.

§ 12.4 Progress Payments

§ 12.4.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner provided in the Contract Documents.

§ 12.4.2 The Contractor shall promptly pay each subcontractor and supplier, upon receipt of payment from the Owner, an amount determined in accordance with the terms of the applicable subcontracts and purchase orders.

§ 12.4.3 Neither the Owner nor the Architect shall have responsibility for payments to a subcontractor or supplier.

§ 12.4.4 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 requirements of the Contract Documents.

§ 12.5 Substantial Completion

§ 12.5.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.

§ 12.5.2 When the Contractor believes that the Work or designated portion thereof is substantially complete, it will notify the Architect and the Architect will make an inspection to determine whether the Work is substantially complete. When the Architect determines that the Work is substantially complete, the Architect shall prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, establish the responsibilities of the Owner and Contractor, 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.

§ 12.6 Final Completion and Final Payment

§ 12.6.1 Upon receipt of a final Application for Payment, the Architect will inspect the Work. When the Architect finds the Work acceptable and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment.

§ 12.6.2 Final payment shall not become due until the Contractor submits to the Architect releases and waivers of liens, and data establishing payment or satisfaction of obligations, such as receipts, claims, security interests, or encumbrances arising out of the Contract.

§ 12.6.3 Acceptance of final payment by the Contractor, a subcontractor or 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 13 PROTECTION OF PERSONS AND PROPERTY

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs, including all those required by law in connection with performance of the Contract. The Contractor shall take reasonable precautions to prevent damage, injury, or loss to employees on the Work and other persons who may be affected thereby, the Work and materials and equipment to be incorporated therein, and other property at the site or adjacent thereto. The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, or by anyone for whose acts the Contractor may be liable.

ARTICLE 14 CORRECTION OF WORK

§ 14.1 The Contractor shall promptly correct Work rejected by the Architect as failing to conform to the requirements of the Contract Documents. The Contractor shall bear the cost of correcting such rejected Work, including the costs of uncovering, replacement, and additional testing.

§ 14.2 In addition to the Contractor's other obligations including warranties under the Contract, the Contractor shall, for a period of one year after Substantial Completion, correct work not conforming to the requirements of the Contract Documents.

§ 14.3 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 7.3.

ARTICLE 15 MISCELLANEOUS PROVISIONS

§ 15.1 Assignment of Contract

Neither party to the Contract shall assign the Contract as a whole without written consent of the other.

§ 15.2 Tests and Inspections

§ 15.2.1 At the appropriate times, the Contractor shall arrange and bear cost of tests, inspections, and approvals of portions of the Work required by the Contract Documents or by laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities.

§ 15.2.2 If the Architect requires additional testing, the Contractor shall perform those tests.

§ 15.2.3 The Owner shall bear cost of tests, inspections, or approvals that do not become requirements until after the Contract is executed. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 15.3 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules.

ARTICLE 16 TERMINATION OF THE CONTRACT

§ 16.1 Termination by the Contractor

If the Work is stopped under Section 12.3 for a period of 14 days through no fault of the Contractor, the Contractor may, upon seven additional days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed including reasonable overhead and profit, and costs incurred by reason of such termination.

§ 16.2 Termination by the Owner for Cause

§ 16.2.1 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 for materials or labor in accordance with the respective agreements between the Contractor and the subcontractors;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 is otherwise guilty of substantial breach of a provision of the Contract Documents.

§ 16.2.2 When any of the above reasons exist, the Owner, after consultation with the Architect, 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' written notice, terminate employment of the Contractor and may

- .1 take possession of the site and of all materials thereon owned by the Contractor, and
- .2 finish the Work by whatever reasonable method the Owner may deem expedient.

§ 16.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 16.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 16.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the Owner. This obligation for payment shall survive termination of the Contract.

§ 16.3 Termination by the Owner for Convenience

The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause. The Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 17 OTHER TERMS AND CONDITIONS

(Insert any other terms or conditions below.)

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

(If required by law, insert cancellation period, disclosures or other warning statements above the signatures.)

OWNER (Signature)

(Printed name and title)

CONTRACTOR (Signature)

(Printed name and title)

LICENSE NO.:

JURISDICTION:

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Oneida Nation – Modifications to:

AIA Document A105 – 2017

Standard Form of Agreement Between Owner and Contractor

Revised: April 10, 2018

ARTICLE 17 OTHER TERMS AND CONDITIONS

- 17.1.1 In the event of any inconsistency between this Exhibit and any other provision of this Agreement, this Exhibit shall control.
- 17.1.2 Add Subparagraph “6.4.1 The Owner has all common law, statutory and other reserved rights to drawings, specifications and other documents prepared by the Architect, including all copyright and other intellectual property, which would normally be retained by the Architect.”
- 17.1.3 Add Subparagraph “8.6.1 Section IV subparagraph F.3.b of the State of Wisconsin Department of Revenue Publication 207 (10/00), titled Sales and Use Tax Information for Contractors (www.dor.state.wi.us/pubs/00pb207), indicates non-native American contractors may be exempt from Wisconsin State sales tax on certain construction materials delivered to the reservation for use in Tribal projects if Federal Preemption applies. Federal Preemption applies to the Oneida Reservation.”
- 17.1.4 Add Subparagraph “8.6.1.1 It is the Contractors responsibility to ascertain the applicability of this State publication to this Tribal project. Contractors who are uncertain as to what items are subject to tax, or who require further explanation or clarification, are requested to contact the Wisconsin Department of Revenue.”
- 17.1.5 Modify Subparagraph 12.2.1 by adding the following to the end of the paragraph: “Owner will require proof of insurance for any materials and equipment stored off the site that the Contractor is requesting payment for.”
- 17.1.6 Add Subparagraph “12.2.3 Such applications shall be accompanied by waivers of liens from Contractor, all Sub-contractors and material suppliers reflecting the amount of the previous applications paid by Owner.”
- 17.1.7 Add Subparagraph “12.6.2.1 Final payment will not be made by Owner until close-out documents (warranties, Operations & Maintenance Manuals, and Contractor as-built mark-ups) have been submitted to and accepted by the Architect and Owner.”
- 17.1.8 Modify Paragraph 15.3 by deleting the following at the end of the paragraph: “, excluding that jurisdiction’s choice of law rules.” Add the following to the end of the paragraph: “The location of this project is under the jurisdiction of the Oneida Nation.”
- 17.1.9 Modify Paragraph 16.3 by deleting the following at the end of the paragraph: “, along with reasonable overhead and profit on the Work not executed.”
- 17.1.10 Contractor shall have a qualified superintendent on the project site at all times during the Project while work is being performed.
 - 17.1.10.1 The Owner shall have the right to review the qualifications of Contractor’s superintendent, including by personal interview, and reject the superintendent at

Owner's discretion. Contractor will not be entitled to additional compensation for replacing superintendent.

17.1.10.2 Contractor shall not change the superintendent during the course of the Project without the written approval of the Owner. Contractor's proposed superintendent substitution shall be subject to subparagraph 17.1.10.1 of Exhibit A.

17.1.11 RIGHT OF AUDIT PROVISIONS: The following elements of this provision apply only to work under and in compliance with this agreement.

17.1.11.1 Contractor's records which shall include but not be limited to accounting records (hard copy, as well as computer readable data if it can be made available), written policies and procedures; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, etc.); original documentation covering negotiated settlements; back charge logs and supporting documentation; general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends; and any other supporting evidence deemed necessary by the Owner to substantiate charges related to this contract (all foregoing hereinafter referred to as "records") shall be open to inspection and subject to audit and/or reproduction by Owner's agent or its authorized representative to the extent necessary to adequately permit evaluation and verification of (1) compliance with contract requirements, (2) proper pricing of time and materials and change orders, (3) compliance with Owner's Business Ethics policies, and (4) claims submitted by the Contractor or any of his payees pursuant to the execution of the contract.

17.1.11.2 Such audits may require inspection and copying from time to time and at reasonable times and places of any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase orders, bids, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may in Owner's judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Document. Such records subject to audit shall also include, but not be limited to, those records necessary to evaluate and verify direct and indirect costs, (including overhead allocations) as they may apply to costs associated with this contract.

17.1.11.3 The Owner or its designee shall be afforded access to all of the Contractor's records, and shall be allowed to interview any of the Contractor's employees, pursuant to the provisions of this article throughout the term of this contract and for a period of three years after final payment or longer if required by law.

17.1.11.4 Contractor shall require all subcontractors to comply with the provisions of this article by insertion of the requirements hereof in a written contract agreement between Contractor and payee. Such requirements will also apply to Subcontractors and Sub-Subcontractors (including those entering into lump sum subcontracts) to cooperate fully in furnishing or in making available to Owner from time to time whenever requested in an expeditious manner any and all such information, materials and data.

17.1.11.5 Owner's agent or its authorized representative shall have access to the Contractor's facilities, shall be allowed to interview all current or former employees to discuss

matters pertinent to the performance of this contract, shall have access to all necessary records, and shall be provided adequate and appropriate work space, in order to conduct audits in compliance with this article.

17.1.12 DISPUTE RESOLUTION:

- 17.1.12.1 Any claim, disputes or controversies arising out of, or in relation to the interpretation, application or enforcement of this Agreement shall be initially negotiated between the designated project representatives of both parties.
- 17.1.12.2 If negotiation between designated project representatives does not result in a settlement of the matter, it shall be referred to the president of the Contractor and the Community & Economic Development Division Director for the Owner, for joint discussion and attempted resolution of the matter.
- 17.1.12.3 Both parties agree that if the matter cannot be resolved by mutual agreement of the principals, the matter will be referred to an alternate dispute resolution process which shall be mediation. Both parties agree that any claim, dispute or other matter in question arising out of or related to this agreement shall not be subject to arbitration. The parties shall endeavor to settle disputes by mediation in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Demand for mediation shall be filed in writing with the other party to this Agreement and with the American Arbitration Association. A demand for mediation shall be made within a reasonable time after the claim, dispute or other matter in question has arisen. In no event shall the demand for mediation be made after the date when institution of legal or equitable proceedings based on such claim, dispute or other matter in question would be barred by the applicable statute of limitations.
- 17.1.12.4 Mediator shall be selected by and mutually agreed to by both parties. The parties shall share the mediator's fee and any filing fees equally.
- 17.1.12.5 The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Mediator shall hear the matter and provide an informal opinion and advice, none of which shall be binding on the parties, but is expected by the parties to help resolve the dispute. Said informal opinion and advice shall be submitted to the parties within twenty (20) days following written demand for mediation.
- 17.1.12.6 Nothing in this contract will be interpreted as a waiver of Owner's sovereign immunity.
- 17.1.13 The failure of one party to insist upon or enforce, in any instance, strict performance by the other party of any of the terms of this Agreement, shall not be construed as a waiver or relinquishment to any extent of the right to assert or rely upon such terms or right on any future occasion.
- 17.1.14 Contractor is required to obtain an Oneida Vendors License from the Owner's Licensing Department. Failure to obtain and maintain said license for the duration of this Agreement shall prohibit Contractor from receiving payment for services rendered, until such time as the license is obtained.

17.1.15 The Contractor is obligated by the requirements of the Oneida Nation Code of Laws *Chapter 502 - Indian Preference in Contracting Law*, understands their provisions and their bearing on the Contractor's rights and responsibilities, and agrees that such provisions shall govern the Contractor's performance of the contract.

17.1.15.1 Contractor shall require all Subcontractors to comply with the provisions of this article by insertion of the requirements hereof in a written contract agreement between Contractor and Subcontractor.

17.1.16 Changes in the Work, for Change Orders that include an adjustment to the Contract Sum, the allowance for overhead and profit included in the total cost shall be based upon one of the following:

17.1.16.1 For Work performed by the Contractor's own forces, maximum ____ percent of the cost.

17.1.16.2 For Work performed by the Contractor's Subcontractor, maximum ____ percent of the cost.

Document 00 73 35 – INDIAN PREFERENCE LAW

1. GENERAL

1.1. REQUIREMENTS

- A. The Contractor is contractually obligated to abide by the Oneida Code of Laws, Title 5. Business - Chapter 502 - Indian Preference in Contracting (aka: Oneida Indian Preference Law).
- B. Per Article 502.9 of the law, the Contractor shall execute a compliance agreement with the Indian Preference Office.
- C. The Oneida Indian Preference Law and Compliance Agreement documents are included in the Project Manual following this Document.

END OF 00 73 35 – INDIAN PREFERENCE LAW

**ONEIDA INDIAN PREFERENCE LAW and COMPLIANCE AGREEMENT DOCUMENTS
FOLLOW**

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Document 00 73 43 – WAGE RATE REQUIREMENTS

1. GENERAL

1.1. APPLICABILITY

- A. Wage rates apply to workers hired from the Oneida Skills Bank, workers shall be paid according to the Wage Rate Determination established by the Indian Preference Office.
- B. Wage rates for workers not from the Oneida Skills Bank shall be determined by the normal salary practices of the Contractor.

1.2. REQUIREMENTS

- A. No less than the wage rates listed in the Wage Rate Determination shall be paid to an individual for performing work in the classification indicated regardless of any contractual relationship that may exist between such individuals and the Contractor(s) or Subcontractors.
- B. Any wage paid for classification of work not included in Wage Rate Determination shall be not less than applicable wage rates determined by appropriate officials responsible for wage rate determinations. When determination has been made after employment of an individual such minimum rate shall be retroactive to time of initial employment.
 - 1. When wages are related to a Skills Bank – qualified trades worker, hired under the requirements of Indian Preference Law, the appropriate official to determine applicable wage shall be the Oneida Indian Preference Coordinator.
- C. Specified wage rates are minimum. Contractors may pay rates in excess of applicable rates. The Owner will consider no claims resulting from payment by Contractor(s) of rates in excess of minimum rate scheduled.
- D. All claims, disputes pertaining to classification of labor employed on the project shall be decided by the appropriate agency as required by Oneida law.
- E. Wages for all workers on site will be reviewed via the required submission of Certified Payroll Reports to the Indian Preference Office.

END OF 00 73 43 – WAGE RATE REQUIREMENTS

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and Drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Elder Service/Apartment Improvements, Project Number 05-013.

1. Project Location: 2907 S. Overland Drive, Oneida, WI 54155.

B. Owner: Oneida Nation, P.O. Box 365 Oneida, WI 54155.

1. Owner's Representative: Oneida Engineering Department. Little Bear Development Center, N7331 Water Circle Place, Oneida, WI 54155.

C. Architect: Oneida Total Integrated Enterprises (OTIE), 2555 Packerland Dr., Green Bay, WI 54313.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. The proposed project includes the construction of four (4) multi stall garages with tenant storage. Garages will be attached with enclosed walkways and secured access to the existing apartments. The construction of an approximately 4,000 ft2 building to accommodate the needs of the Loan Closet and Home Chore Programs. Project includes all other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

- a. Oneida Elder Services and Apartment Improvements.

1.4 ACCESS TO SITE

- A. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to areas indicated on drawings.
 - 2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.5 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Architect and Owner not less than three days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Controlled Substances: Use of tobacco products and other controlled substances within the existing building and on the Project site is not permitted.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

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

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.

- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution will not adversely affect Contractor's construction schedule.

- c. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - d. Requested substitution is compatible with other portions of the Work.
 - e. Requested substitution has been coordinated with other portions of the Work.
 - f. Requested substitution provides specified warranty.
 - g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

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SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on form included in Project Manual.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect or Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect or Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect or Construction Manager.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Architect or Construction Manager will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Construction Manager may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 012900 - PAYMENT PROCEDURES

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 administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 4. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
 5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract, as described in Section 011000 "Summary."
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange schedule of values consistent with format of AIA Document G703.
 3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
 6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

7. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
9. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
11. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the 5th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- F. Transmittal: Submit one signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Sustainable design submittal for project materials cost data.
 4. Contractor's construction schedule (preliminary if not final).
 5. Sustainable design action plans
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706.
 5. AIA Document G706A.
 6. AIA Document G707.
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination drawings.
 - 2. RFIs.
 - 3. Project Website.
 - 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

- A. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

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

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Architect will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
 - 1. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 - 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 - 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
 - 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of Record Documents.
 - l. Use of the premises and existing building.
 - m. Work restrictions.
 - n. Working hours.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for moisture and mold control.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. First aid.
 - x. Security.
 - y. Progress cleaning.
 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - l. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.
 - q. Acceptability of substrates.
 - r. Temporary facilities and controls.
 - s. Space and access limitations.
 - t. Regulations of authorities having jurisdiction.
 - u. Testing and inspecting requirements.
 - v. Installation procedures.
 - w. Coordination with other work.
 - x. Required performance results.
 - y. Protection of adjacent work.
 - z. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Status of sustainable design documentation.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site use.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of Proposal Requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.
 - 19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's Construction Schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Site condition reports.
- B. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for preparing a combined Contractor's Construction Schedule.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Owner.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF file.
- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
 - 3. Total Float Report: List of activities sorted in ascending order of total float.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at monthly intervals.
- G. Site Condition Reports: Submit at time of discovery of differing conditions.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.

2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 4. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use-of-premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 5. Work Stages: Indicate important stages of construction for each major portion of the Work.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and the Contract Time.
- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

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

2.2 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.
 - 1. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Accidents.
 - 8. Meetings and significant decisions.
 - 9. Unusual events.
 - 10. Stoppages, delays, shortages, and losses.
 - 11. Meter readings and similar recordings.
 - 12. Emergency procedures.
 - 13. Orders and requests of authorities having jurisdiction.
 - 14. Change Orders received and implemented.
 - 15. Services connected and disconnected.
 - 16. Equipment or system tests and startups.
 - 17. Partial completions and occupancies.
 - 18. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

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SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

1.2 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Submit photos on CD-ROM or thumb-drive. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description:
 - a. Name of Project.
 - b. Date photograph was taken.
 - c. Description of location, vantage point, and direction.
- C. Construction Photographs: Submit two sets of prints of each photographic view within seven days of taking photographs.

1.3 USAGE RIGHTS

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

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, with minimum size of 8 megapixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
- D. Periodic Construction Photographs: Take 20 photographs bi-weekly. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 ACTION SUBMITTALS

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

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.

- i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations: Identify deviations from the Contract Documents on submittals.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS (Not Used)

2.1 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
 - a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

2.2 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

- a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
4. Paper Transmittal: Include paper transmittal including complete submittal information indicated.
5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed

before installation of product, for compliance with performance requirements in the Contract Documents.

5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

2.3 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement

certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

3.2 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will discard submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

END OF SECTION 013300

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SECTION 013516 - ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes special procedures for alteration work.

1.3 DEFINITIONS

- A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- B. Consolidate: To strengthen loose or deteriorated materials in place.
- C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
- I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
- K. Retain: To keep existing items that are not to be removed or dismantled.

- L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 MATERIALS OWNERSHIP

- A. Historic 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 Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1.5 INFORMATIONAL SUBMITTALS

- A. Alteration Work Program: Submit 30 days before work begins.
- B. Fire-Prevention Plan: Submit 30 days before work begins.

1.6 QUALITY ASSURANCE

- A. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.
- B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.
 - 1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
 - 2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.
- C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.
- D. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.7 STORAGE AND HANDLING OF SALVAGED MATERIALS

- A. Salvaged Materials:
 - 1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.

2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.

5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

F. Existing Roofing: Prior to the start of work in an area, install roofing protection as indicated on Drawings.

3.2 PROTECTION DURING APPLICATION OF CHEMICALS

- A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.
- B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant

and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

- C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
- D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.
- E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.3 GENERAL ALTERATION WORK

- A. Have specialty work performed only by qualified specialists.
- B. Ensure that supervisory personnel are present when work begins and during its progress.
- C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs. Comply with requirements in Section 013233 "Photographic Documentation."
- D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.
- E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
 - 1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 013516

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of **five** previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- D. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- E. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

- F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- G. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- H. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.

2. Project title and number.
 3. Name, address, telephone number, and email address of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgements, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to **ASTM E 329**; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 - 1. Notify testing agencies at least **24** hours in advance of time when Work that requires testing or inspection will be performed.
 - 2. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 3. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 4. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- F. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspection equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.

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

END OF SECTION 014000

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SECTION 014200 - REFERENCES

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 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 - 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 7. ABMA - American Boiler Manufacturers Association; www.abma.com.
 - 8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org
 - 9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 11. AF&PA - American Forest & Paper Association; www.afandpa.org.
 - 12. AGA - American Gas Association; www.aga.org.
 - 13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 - 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 15. AI - Asphalt Institute; www.asphaltinstitute.org.
 - 16. AIA - American Institute of Architects (The); www.aia.org.
 - 17. AISC - American Institute of Steel Construction; www.aisc.org.
 - 18. AISI - American Iron and Steel Institute; www.steel.org.
 - 19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
 - 20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
 - 21. ANSI - American National Standards Institute; www.ansi.org.
 - 22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 - 23. APA - APA - The Engineered Wood Association; www.apawood.org.
 - 24. APA - Architectural Precast Association; www.archprecast.org.
 - 25. API - American Petroleum Institute; www.api.org.
 - 26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
 - 27. ARI - American Refrigeration Institute; (See AHRI).

28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CE - Conformite Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking/>
51. CEA - Canadian Electricity Association; www.electricity.ca.
52. CEA - Consumer Electronics Association; www.ce.org.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.pbmdf.com.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa.ca.
65. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
66. CSI - Construction Specifications Institute (The); www.csinet.org.
67. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHI - Door and Hardware Institute; www.dhi.org.

72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; www.eciaonline.org.
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; www.eima.com.
77. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
78. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); www.intertek.com.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.
82. FCI - Fluid Controls Institute; www.fluidcontrolsintstitute.org.
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
85. FM Approvals - FM Approvals LLC; www.fmglobal.com.
86. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarooft.com.
88. FSA - Fluid Sealing Association; www.fluidsealing.com.
89. FSC - Forest Stewardship Council U.S.; www.fscus.org.
90. GA - Gypsum Association; www.gypsum.org.
91. GANA - Glass Association of North America; www.glasswebsite.com.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
97. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
98. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
99. IAS - International Accreditation Service; www.iasonline.org.
100. IAS - International Approval Services; (See CSA).
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; www.iccsafe.org.
103. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
104. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
105. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
106. IEC - International Electrotechnical Commission; www.iec.ch.
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
111. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
112. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
113. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
114. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
115. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.

116. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
117. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
118. ISO - International Organization for Standardization; www.iso.org.
119. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
120. ITU - International Telecommunication Union; www.itu.int/home.
121. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
122. LMA - Laminating Materials Association; (See CPA).
123. LPI - Lightning Protection Institute; www.lightning.org.
124. MBMA - Metal Building Manufacturers Association; www.mbma.com.
125. MCA - Metal Construction Association; www.metalconstruction.org.
126. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
127. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
128. MHIA - Material Handling Industry of America; www.mhia.org.
129. MIA - Marble Institute of America; www.marble-institute.com.
130. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
131. MPI - Master Painters Institute; www.paintinfo.com.
132. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
133. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
134. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
135. NADCA - National Air Duct Cleaners Association; www.nadca.com.
136. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
137. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
138. NBI - New Buildings Institute; www.newbuildings.org.
139. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
140. NCMA - National Concrete Masonry Association; www.ncma.org.
141. NEBB - National Environmental Balancing Bureau; www.nebb.org.
142. NECA - National Electrical Contractors Association; www.necanet.org.
143. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
144. NEMA - National Electrical Manufacturers Association; www.nema.org.
145. NETA - InterNational Electrical Testing Association; www.netaworld.org.
146. NFHS - National Federation of State High School Associations; www.nfhs.org.
147. NFPA - National Fire Protection Association; www.nfpa.org.
148. NFPA - NFPA International; (See NFPA).
149. NFRC - National Fenestration Rating Council; www.nfrc.org.
150. NHLA - National Hardwood Lumber Association; www.nhla.com.
151. NLGA - National Lumber Grades Authority; www.nlga.org.
152. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
153. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
154. NRCA - National Roofing Contractors Association; www.nrca.net.
155. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
156. NSF - NSF International; www.nsf.org.
157. NSPE - National Society of Professional Engineers; www.nspe.org.
158. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
159. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
160. NWFA - National Wood Flooring Association; www.nwfa.org.
161. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
162. PDI - Plumbing & Drainage Institute; www.pdionline.org.

163. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); <http://www.plasa.org>.
164. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
165. RFCI - Resilient Floor Covering Institute; www.rfci.com.
166. RIS - Redwood Inspection Service; www.redwoodinspection.com.
167. SAE - SAE International; www.sae.org.
168. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
169. SDI - Steel Deck Institute; www.sdi.org.
170. SDI - Steel Door Institute; www.steeldoor.org.
171. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
172. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
173. SIA - Security Industry Association; www.siaonline.org.
174. SJI - Steel Joist Institute; www.steeljoist.org.
175. SMA - Screen Manufacturers Association; www.smainfo.org.
176. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
177. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
178. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
179. SPIB - Southern Pine Inspection Bureau; www.spib.org.
180. SPRI - Single Ply Roofing Industry; www.spri.org.
181. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
182. SSINA - Specialty Steel Industry of North America; www.ssina.com.
183. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
184. STI - Steel Tank Institute; www.steeltank.com.
185. SWI - Steel Window Institute; www.steelwindows.com.
186. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
187. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
188. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
189. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
190. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
191. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
192. TMS - The Masonry Society; www.masonrysociety.org.
193. TPI - Truss Plate Institute; www.tpinst.org.
194. TPI - Turfgrass Producers International; www.turfgrasssod.org.
195. TRI - Tile Roofing Institute; www.tilerroofing.org.
196. UL - Underwriters Laboratories Inc.; <http://www.ul.com>.
197. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
198. USAV - USA Volleyball; www.usavolleyball.org.
199. USGBC - U.S. Green Building Council; www.usgbc.org.
200. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
201. WA - Wallcoverings Association; www.wallcoverings.org.
202. WASTEC - Waste Equipment Technology Association; www.wastec.org.
203. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
204. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
205. WDMA - Window & Door Manufacturers Association; www.wdma.com.
206. WI - Woodwork Institute; www.wicnet.org.
207. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.

208. WWPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).

4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS; California Department of Health Services; (See CDPH).
 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservation.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

- A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within **seven** days of receipt of a comparable product

request. Architect will notify Contractor of approval or rejection of proposed comparable product request within **15** days of receipt of request, or **seven** days of receipt of additional information or documentation, whichever is later.

- a. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
- b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

- B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

- C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

- a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: ..."
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **will not** be considered.
 4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
 5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **will not** be considered.
 6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by **land surveyor** certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.3 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and

- patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, **mechanical and electrical systems**, and other construction affecting the Work.
 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to **local utility** that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a **land surveyor** to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

4. Inform installers of lines and levels to which they must comply.
 5. Check the location, level and plumb, of every major element as the Work progresses.
 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- B. Benchmarks: Establish and maintain a minimum of **two** permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.

- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to **prevent** interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. **Concrete and Masonry**: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

- a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
- 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Action Submittals:

1. Waste Management Plan: Submit plan within seven 7 days of date established for commencement of the Work.

B. Informational Submittals:

1. Waste Reduction Progress Reports: Submit concurrent with each Application for Payment. Include total quantity of waste, total quantity of waste salvaged and recycled, and percentage of total waste salvaged and recycled.
2. Records of Donations and Sales: Receipts for salvageable waste donated or sold to individuals and organizations. Indicate whether organization is tax exempt.
3. Recycling and Processing Facility Records: Manifests, weight tickets, receipts, and invoices.
4. Landfill and Incinerator Disposal Records: Manifests, weight tickets, receipts, and invoices.

C. Waste Management Conference: Conduct conference at Project site. Review methods and procedures related to waste management.

D. Waste Management Plan: Develop a waste management plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

1. Salvaged Materials for Reuse: Identify materials that will be salvaged and reused.
2. Salvaged Materials for Sale: Identify materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: Identify materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ##### A. Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - 1. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

3.2 SALVAGING DEMOLITION WASTE (Especially Window Treatments)

- A. Salvaged Items for Reuse in the Work: Clean salvaged items and install salvaged items to comply with installation requirements for new materials and equipment.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use: Clean salvaged items and store in a secure area until delivery to Owner.

3.3 RECYCLING WASTE

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- C. Wood Materials: (at contractor's discretion)
 - 1. Sort and stack reusable members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
 - 2. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 3. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- D. Metals: Separate metals by type.
- E. Gypsum Board: (at contractor's discretion).

3.4 DISPOSAL OF WASTE

- A. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
- B. Do not burn waste materials.

END OF SECTION 017419

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 3. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at final completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by **Architect**. Label with manufacturer's name and model number.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain **Architect's** signature for receipt of submittals.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit sustainable design submittals not previously submitted.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."

6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of **10** days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order, **starting with exterior areas first**.
 - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 3. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect will return annotated file.
 - b. PDF electronic file. Architect will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within [15] **<Insert number>** days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- E. Warranties in Paper Form:
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive **8-1/2-by-11-inch (215-by-280-mm)** paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

- j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - 2. Enable inserted reviewer comments on draft submittals.
- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- C. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Architect.
 - 7. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, [loose-leaf][post-type] binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper, with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name,[and] subject matter of contents[, and indicate Specification Section number on the bottom of spine]. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

- E. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's Name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and

telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

- D. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.

- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
- B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it.
 - c. Record and check the markup before enclosing concealed installations.
 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

END OF SECTION 017839

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SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration of operation of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

1.4 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.

- e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

3.2 INSTRUCTION

- A. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least **seven** days' advance notice.
- B. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

END OF SECTION 017900

02 41 19 SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from trash dumps shown.

1.2 RELATED WORK:

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished.
- B. Safety Requirements: Section 01 35 26 Safety Requirements Article, ACCIDENT PREVENTION PLAN (APP).
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.

1.3 PROTECTION:

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
 - 1. No wall or part of wall shall be permitted to fall outwardly from structures.
 - 3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
 - 4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the tribe; any damaged items shall be repaired or replaced as approved by the Contractor. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.
- H. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

1.4 UTILITY SERVICES:

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION:

- A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
 - 1. As required for installation of new utility service lines.
 - 2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.
- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the property to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Resident Engineer. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable tribal, federal, state or local permits, rules and/or regulations.
- D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable tribal, federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.
- E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Resident Engineer. When Utility lines are encountered that are not indicated on the

drawings, the Resident Engineer shall be notified prior to further work in that area.

3.2 CLEAN-UP:

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Resident Engineer.

Clean-up shall include off the property of all items and materials not required to remain property of the tribe as well as all debris and rubbish resulting from demolition operations.

- - - E N D - - -

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies wood blocking, framing, sheathing, furring, nailers, rough hardware, and light wood construction.

1.2 RELATED WORK:

- A. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.
- B. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.
- C. Manufacturer's Literature and Data:
 - 1. Submit data for lumber, panels, hardware and adhesives.
 - 2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.
- D. Manufacturer's certificate for unmarked lumber.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having

firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 QUALITY ASSURANCE:

- A. Installer: A firm with a minimum of three (3) years' experience in the type of work required by this section.

1.6 GRADING AND MARKINGS:

- A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on site for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):
- NDS-15.....National Design Specification for Wood
Construction
- WCD1-01.....Details for Conventional Wood Frame
Construction
- C. American Institute of Timber Construction (AITC):
- A190.1-07.....Structural Glued Laminated Timber
- D. American Society of Mechanical Engineers (ASME):
- B18.2.1-12(R2013).....Square and Hex Bolts and Screws
- B18.2.2-10.....Square and Hex Nuts
- B18.6.1-81(R2008).....Wood Screws
- E. American Plywood Association (APA):
- E30-11.....Engineered Wood Construction Guide
- F. ASTM International (ASTM):
- A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process
- C954-11.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness

- C1002-14.....Steel Self-Piercing Tapping Screws for the
Application of Gypsum Panel Products or Metal
Plaster Bases to Wood Studs or Metal Studs
- D198-14.....Test Methods of Static Tests of Lumber in
Structural Sizes
- D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer
Matrix Composite Materials and Their Laminates
- D2559-12a.....Adhesives for Structural Laminated Wood
Products for Use Under Exterior (Wet Use)
Exposure Conditions
- D3498-03(R2011).....Adhesives for Field-Gluing Plywood to Lumber
Framing for Floor Systems
- D6108-13.....Test Method for Compressive Properties of
Plastic Lumber and Shapes
- D6109-13.....Test Methods for Flexural Properties of
Unreinforced and Reinforced Plastic Lumber and
Related Products
- D6111-13a.....Test Method for Bulk Density and Specific
Gravity of Plastic Lumber and Shapes by
Displacement
- D6112-13.....Test Methods for Compressive and Flexural Creep
and Creep-Rupture of Plastic Lumber and Shapes
- F844-07a(R2013).....Washers, Steel, Plan (Flat) Unhardened for
General Use
- F1667-13.....Nails, Spikes, and Staples
- G. American Wood Protection Association (AWPA):
AWPA Book of Standards
- H. Commercial Item Description (CID):
A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self
Threading Anchors)
- I. Forest Stewardship Council (FSC):
FSC-STD-01-001(Ver. 4-0)FSC Principles and Criteria for Forest
Stewardship
- J. Military Specification (Mil. Spec.):
MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated
- K. Environmental Protection Agency (EPA):
40 CFR 59(2014).....National Volatile Organic Compound Emission
Standards for Consumer and Commercial Products

L. Truss Plate Institute (TPI):

TPI-85.....Metal Plate Connected Wood Trusses

M. U.S. Department of Commerce Product Standard (PS)

PS 1-95.....Construction and Industrial Plywood

PS 20-10.....American Softwood Lumber Standard

N. ICC Evaluation Service (ICC ES):

AC09.....Quality Control of Wood Shakes and Shingles

AC174.....Deck Board Span Ratings and Guardrail Systems
(Guards and Handrails)

PART 2 - PRODUCTS

2.1 LUMBER:

A. Unless otherwise specified, each piece of lumber must bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.

1. Identifying marks are to be in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.

2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Structural Members: Species and grade as listed in the AFPA NDS having design stresses as shown.

C. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.

2. Framing lumber: Minimum extreme fiber stress in bending of 7584 kPa (1100 PSI).

3. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.

4. Board Sub-flooring: Shiplap edge, 25 mm (1 inch) thick, not less than 203 mm (8 inches) wide.

D. Sizes:

1. Conforming to PS 20.

2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:

1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
 - a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
 - b. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:

1. Comply with Mil Spec. MIL-L-19140.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

2.2 PLYWOOD:

- A. Comply with PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:
 1. APA rated Exposure 1 or Exterior; panel grade CD or better.
 2. Wall sheathing:

- a. Minimum 9 mm (11/32 inch) thick with supports 406 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 610 mm (24 inches) on center unless specified otherwise.
 - b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
- 3. Roof sheathing:
 - a. Minimum 9 mm (11/32 inch) thick with span rating 24/0 or 12 mm (15/32 inch) thick with span rating for supports 406 mm (16 inches) on center unless specified otherwise.
 - b. Minimum 15 mm (19/32 inch) thick or span rating of 40/20 or 18 mm (23/32 inch) thick or span rating of 48/24 for supports 610 mm (24 inches) on center.
- D. Subflooring:
 - 1. Under finish wood flooring or underlayment:
 - a. APA Rated sheathing, Exposure 1. panel grade CD.
 - b. Minimum 15 mm (19/32 inch) thick with span rating 32/16 or greater for supports at 406 mm (16 inches) on center and 18.25 mm (23/32 inch) thick with span rating 48/24 for supports at 610 mm (24 inches) on center.
- E. Underlayment:
 - 1. APA rated Exposure 1 or Exterior, panel grade C-C Plugged.
 - 2. Minimum 6 mm (1/4 inch) thick or greater over plywood subflooring unless otherwise shown.

2.3 STRUCTURAL-USE PANELS:

- A. Comply with APA E30.
- B. Bearing the mark of a recognized association or independent agency that maintains continuing control over quality of panel which identifies compliance by end use, Span Rating, and exposure durability classification.
- C. Wall and Roof Sheathing:
 - 1. APA Rated sheathing panels, durability classification of Exposure 1 or Exterior Span Rating of 16/0 or greater for supports 406 mm (16 inches) on center and 24/0 or greater for supports 610 mm (24 inches) on center.
- D. Subflooring:
 - 1. Under finish wood flooring or underlayment:

- a. APA rated sheathing panels, durability classification of Exposure 1 or Exterior.
- b. Span Rating of 24/16 or greater for supports 406 mm (16 inches).
- 2. Under resilient floor or carpet.
 - a. APA rated combination subfloor-underlayment grade panels, durability classification of Exposure 1 or Exterior T and G.
 - b. Span Rating of 16 or greater for supports 406 mm (16 inches) on center and 24 or greater for supports 610 mm (24 inches) on center.
- E. Underlayment:
 - 1. APA rated Exposure 1.
 - 2. Minimum 6 mm (1/4 inch) thick or greater over subfloor.
- F. Wood "I" Beam Members:
 - 1. Size and Shape as indicated in contract documents.
 - 2. Cambered and marked "TOP UP".
 - 3. Plywood webs: PS-1, minimum 9 mm (3/8 inch) thick, unless shown otherwise.
 - 4. Flanges: Kiln dried stress rated dense lumber minimum 38 mm (1-1/2 inch) thick, width as indicated on contract documents.
 - 5. Plywood web fitted into flanges and joined with ASTM D2559 adhesive to form "I" beam section unless shown otherwise.

2.4 ROUGH HARDWARE AND ADHESIVES:

- A. Anchor Bolts:
 - 1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
 - 2. Extend at least 203 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).
- B. Miscellaneous Bolts: Expansion Bolts: C1D A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Provide 13 mm (1/2 inch) bolt unless shown otherwise.
- C. Washers
 - 1. ASTM F844.
 - 2. Provide zinc or cadmium coated steel or cast iron for washers exposed to weather.
- D. Screws:
 - 1. Wood to Wood: ASME B18.6.1 or ASTM C1002.
 - 2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:

1. Size and type best suited for purpose unless noted otherwise.
Provide aluminum-alloy nails, plated nails, or zinc-coated nails,
for nailing wood work exposed to weather and on roof blocking.
2. ASTM F1667:
 - a. Common: Type I, Style 10.
 - b. Concrete: Type I, Style 11.
 - c. Barbed: Type I, Style 26.
 - d. Underlayment: Type I, Style 25.
 - e. Masonry: Type I, Style 27.
 - f. Provide special nails designed for use with ties, strap anchors,
framing connectors, joists hangers, and similar items. Nails not
less than 32 mm (1-1/4 inches) long, 8d and deformed or annular
ring shank.

F. Framing Connectors:

1. Fabricate of ASTM A653/A653M, Grade A; steel sheet not less than
1.3 mm (0.052 inch) thick unless specified otherwise.
2. Framing Angles: Angle designed with bendable legs to provide
three (3) way anchors.
3. Straps:
 - a. Designed to provide wind and seismic ties with sizes as shown or
specified.
 - b. Strap ties not less than 32 mm (1-1/4 inches) wide.
 - c. Punched for fastener.
4. Joist Hangers:
 - a. Fabricated of 1.6 mm (0.063 inch) minimum thick sheet, U design
unless shown otherwise.
 - b. Heavy duty hangers fabricated of minimum 2.7 mm (0.108 inch)
thick sheet, U design with bent top flange to lap over beam.
5. Joist Ties: Mild steel flats, 5 mm by 32 mm
(3/16 inch by 1-1/4 inch) size with ends bent about 30 degrees from
horizontal, and extending at least 406 mm (16 inches) onto framing.
Punch each end for three (3) spikes.
6. Wall Anchors for Joists and Rafters:
 - a. Mild steel strap, 5 mm by 32 mm (3/16 inch by 1-1/4 inch) with
wall ends bent 50 mm (2 inches), or provide 9 mm by 130 mm
(3/8 inch by 5 inch) pin through strap end built into masonry.

- b. Strap long enough to extend onto three joists or rafters, and punched for spiking at each bearing.
- c. Strap not less than 101 mm (4 inches) embedded end.
- 7. Joint Plates:
 - a. Steel plate punched for nails.
 - b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.
 - c. Size for axial eccentricity, and fastener loads.
- G. Adhesives:
 - 1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

- A. Conform to applicable requirements of the following:
 - 1. AFPA NDS for timber connectors.
 - 2. AITC A190.1 Timber Construction Manual for heavy timber construction.
 - 3. AFPA WCD1 for nailing and framing unless specified otherwise.
 - 4. APA for installation of plywood or structural use panels.
 - 5. TPI for metal plate connected wood trusses.
 - //6. Space plastic lumber boards to allow for lengthwise expansion and contraction in accordance with manufacturer recommendations.//
- B. Fasteners:
 - 1. Nails.
 - a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
 - b. Use special nails with framing connectors.
 - c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
 - d. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
 - e. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.

f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.

g. Nailing Schedule; Using Common Nails:

- 1) Joist bearing on sill or girder, toe nail three (3) 8d nails or framing anchor.
- 2) Bridging to joist, toe nail each end two (2) 8d nails.
- 3) Ledger strip to beam or girder three (3) 16d nails under each joint.
- 4) Subflooring or Sheathing:
 - a) 152 mm (6 inch) wide or less to each joist face nail two (2) 8d nails.
 - b) Subflooring, more than 152 mm (6 inches) wide, to each stud or joint, face nail three (3) 8d nails.
 - c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 152 mm (6 inches) on center and at intermediate supports 254 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 305 mm (12 inches) at supported edges and 508 mm (20 inches) o.c. at intermediate supports.
- 5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 406 mm (16 inches) on center.
- 6) Top plate to stud, end nail two (2) 16d nails.
- 7) Stud to sole plate, toe nail or framing anchor. Four (4) 8d nails.
- 8) Doubled studs, face nail 16d at 610 mm (24 inches) on center.
- 9) Built-up corner studs 16d at 610 mm (24 inches) (24 inches) on center.
- 10) Doubled top plates, face nails 16d at 406 mm (16 inches) on center.
- 11) Top plates, laps, and intersections, face nail two (2) 16d.
- 12) Continuous header, two pieces 16d at 406 mm (16 inches) on center along each edge.
- 13) Ceiling joists to plate, toenail three (3) 8d or framing anchor.
- 14) Continuous header to stud, four (4) 16d.
- 15) Ceiling joists, laps over partitions, face nail three (3) 16d or framing anchor.
- 16) Ceiling joists, to parallel rafters, face nail three (3) 16d.

- 17) Rafter to plate, toe nail three (3) 8d or framing anchor.
Brace 25 mm (1 inch) thick board to each stud and plate, face nail three (3) 8d.
- 18) Built-up girders and beams 20d at 812 mm (32 inches) on center along each edge.

SPEC WRITER NOTE: Do not fasten to bottom flange of steel beams.

2. Bolts:

- a. Fit bolt heads and nuts bearing on wood with washers.
 - b. Countersink bolt heads flush with the surface of nailers.
 - c. Embed in concrete and solid masonry or provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
 - d. Provide toggle bolts to hollow masonry or sheet metal.
 - e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.
3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
- a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
 - b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
- a. Where shown or option to nails.
 - b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
 - c. Spaced same as nails.
7. Installation of Timber Connectors:
- a. Conform to applicable requirements of the AFPA NDS.
 - b. Fit wood to connectors and drill holes for fasteners so wood is not split.
- //8. Install plastic lumber with stainless steel bolts or screws; if nails are used use stainless steel spiral shank or ring shank type.//

- C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
1. Space anchor bolts 1219 mm (4 feet) on centers between ends and within 152 mm (6 inches) of end. Stagger bolts from side to side on plates over 178 mm (7 inches) in width.
 2. Provide shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
 3. Closely fit, and set to required lines.
- D. Cut notch, or bore in accordance with AFPA WCD1 passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- E. Blocking Nailers, and Furring:
1. Install furring, blocking, nailers, and grounds where shown.
 2. Provide longest lengths practicable.
 3. Provide fire retardant treated wood blocking where shown at openings and where shown or specified.
 4. Layers of Blocking or Plates:
 - a. Stagger end joints between upper and lower pieces.
 - b. Nail at ends and not over 610 mm (24 inches) between ends.
 - c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.

SPEC WRITER NOTE: Include the following option if acceptable to Architect.

- //5. Fabricate roof edge vent strips with 6 mm by 6 mm (1/4 inch by 1/4 inch) notches, 101 mm (4 inches) on center, aligned to allow for venting of // insulating concrete // // and venting base sheet //. // Option: Texture 1-11 plywood with parallel grooves 101 mm (4 inches) o.c. may be used. //
- //6. Unless otherwise shown, provide wall furring 25 mm by 75 mm (1 inch by 3 inch) continuous wood strips installed plumb on walls, using wood shims where necessary so face of furring forms a true, even plane. Space furring not over 406 mm (16 inches) on centers, butt joints over bearings and rigidly secure in place. Anchor furring on 406 mm (16 inches) centers. //

SPEC WRITER NOTES:

1. Specifications for light wood framing is for solid wood members.

2. Add Specifications for other wood systems when used.
3. Verify framing plans and details show connections and conditions including framing connectors.
4. Coordinate specification with drawings; do not duplicate.

F. Floor // and Ceiling // Framing:

1. Set with crown edge up.
2. Keep framing at least 50 mm (2 inches) away from chimneys.
3. Bear on not less than 101 mm (4 inches) on concrete and masonry, and 38 mm (1-1/2 inches) on wood and metal unless shown otherwise.
4. Support joist, trimmer joists, headers, and beams framing into carrying members at same relative levels on joist hangers unless shown otherwise.
5. Lap and spike wood joists together at bearing, or butt end-to-end with scab ties at joint and spike to plates. Scab tie lengths not less than 203 mm (8 inches) lap on joist ends. Install wood I beam joists as indicated in contract documents.
6. Frame openings with headers and trimmer joist. Double headers carrying more than two tail joists and trimmer joists supporting headers carrying more than one tail joist unless otherwise indicated in contract documents.
7. Drive nails through headers into joists using two (2) nails for 50 mm by 152 mm (2 inch by 6 inch); three (3) nails for 50 mm by 203 mm (2 inch by 8 inch) and four (4) nails for 50 mm by 254 mm (2 inch by 10 inch) and over in size.
8. Install nearest joist to double headers and spike joist to both header members before trimmer joist is installed and secured together.
9. Doubled joists under partitions parallel with floor joists. // Fire cut joists built into masonry or concrete. //
10. Where joists run perpendicular to masonry or concrete, anchor every third joist to masonry or concrete with one (1) metal wall anchor. Securely spike anchors with three (3) nails to side of joist near its bottom.
11. Anchor joists running parallel with masonry or concrete walls to walls with steel flats spaced not over 1828 mm (6 feet) apart. Extend steel flats over at least three (3) joists and into masonry 101 mm (4 inches) with ends turned 50 mm (2 inches); bolt to

concrete. Set top of flats flush with top of joists, and securely nail steel flats to each joist.

12. Hook ties at steel framing over top flange of steel members.
13. Nonbearing partitions running parallel with ceiling joists, install solid 50 mm (2 inch) thick bridging same depth as ceiling joists cut to fit snug between joists for securing top plate of partitions. Securely spike bridging to joists. Space 1219 mm (4 feet) on center.
- //14. Where ceramic tile finish floors are set in Portland cement mortar, nail continuous 50 mm by 75 mm (2 inches by 3 inches) ledgers to sides of joists to support subflooring flush with top of joist. //

SPEC WRITER NOTE: Include the following option if acceptable to structural engineer.

G. Bridging:

1. Provide 25 mm by 75 mm (1 inch by 3 inch) lumber with ends beveled for slope. // Option: Metal bridging may be provided in lieu of wood bridging. //
2. Install one (1) row of bridging for joist spans over 2438 mm (8 feet), but less than 4877 mm (16 feet) long; install two (2) rows for spans over 4877 mm (16 feet) long.
3. Install an extra row of bridging between trimmer and next two (2) joists if header is more than 610 mm (2 feet) from end of trimmer or from regular row of bridging.
4. Secure with two (2) nails at ends.
5. Leave bottom ends loose until after subflooring or roof sheathing is installed.
6. Install single row of bridging at centerline of span and two (2) rows at the third points of span unless otherwise shown.

SPEC WRITER NOTE: Revise roof framing if other wood systems used such as trusses.

H. Roof Framing:

1. Set rafters with crown edge up.
2. Form a true plane at tops of rafters.
3. Valley, Ridge, and Hip Members:
 - a. Size for depth of cut on rafters.
 - b. Straight and true intersections of roof planes.
 - c. Secure hip and valley rafters to wall plates by using framing connectors.

- d. Double valley rafters longer than the available lumber, with pieces lapped not less than 1219 mm (4 feet) and spiked together.
- e. Butt joint and scab hip rafters longer than the available lumber.
- 4. Spike to wall plate and to ceiling joists except when secured with framing connectors.
- 5. Frame openings in roof with headers and trimmer rafters. Double headers carrying more than one (1) rafter unless shown otherwise.
- 6. Install 50 mm by 101 mm (2 inch by 4 inch) strut between roof rafters and ceiling joists at 1219 mm (4 feet) on center unless shown otherwise.
- I. Framing of Dormers:
 - 1. Frame as indicated in contract documents, with top edge of ridge beveled to pitch of roof header.
 - 2. Set studs on doubled trimmer rafters.
 - 3. Double studs at corners of dormers.
 - 4. Double plate on studs and notch rafters over plate and bear at least 75 mm (3 inches) on plates.
 - 5. Frame opening to receive window frame or louver frame.
- J. Partition and Wall Framing:
 - 1. Provide 50 mm by 101 mm (2 inch by 4 inch) studs spaced 406 mm (16 inches) on centers; unless otherwise indicated on contract documents.
 - 2. Install double studs at openings and triple studs at corners.
 - 3. Installation of sole plate:
 - a. Anchor plates of walls or partitions resting on concrete floors in place with expansion bolts, one (1) near ends of piece and at intermediate intervals of not more than 1219 mm (4 feet) or with power actuated drive pins with threaded ends of suitable type and size, spaced 610 mm (2 feet) on center unless shown otherwise.
 - b. Nail plates to wood framing through subfloor as specified in nailing schedule.
 - 4. Headers or Lintels:
 - a. Make headers for openings of two (2) pieces of 50 mm (2 inch) thick lumber of size shown with plywood filler to finish flush with face of studs or solid lumber of equivalent size.
 - b. Support ends of headers on top of stud cut for height of opening. Spike cut stud to adjacent stud. Spike adjacent stud to header.

5. Provide double top plates, with members lapped at least 610 mm (2-feet) spiked together.
6. Install intermediate cut studs over headers and under sills to maintain uniformity of stud spacing.
7. Provide single sill plates at bottom of opening unless otherwise indicated in contract documents. Toe nail to end stud, face nail to intermediate studs.
8. Install 50 mm (2 inch) blocking for firestopping so that maximum dimension of any concealed space is not over 2438 mm (8 feet) in accordance with AFPA WCD1.
9. Install corner bracing when plywood or structural use panel sheathing is not used.
 - a. Let corner bracing into exterior surfaces of studs at an angle of approximately 45 degrees, extended completely over walls plates, and secured at bearing with two (2) nails.
 - b. Provide 25 mm by 101 mm (1 inch by 4 inch) corner bracing.

K. Rough Bucks:

1. Install rough wood bucks at opening in masonry or concrete where wood frames or trim occur.
2. Brace and maintain bucks plumb and true until masonry has been built around them or concrete cast in place.
3. Cut rough bucks from 50 mm (2 inch) thick stock, of same width as partitions in which they occur and of width shown in exterior walls.
4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified.

SPEC WRITER NOTES:

1. Use board subfloor only over wood joist construction. Edit for framing used.
2. Use plywood or structural use panels over steel framing.

L. Subflooring:

1. Subflooring may be either boards, structural-use panels, or plywood.
2. Lay board subflooring diagonally, with close joints. Stagger end joints and make joints over supports. Bear each board on at least three supports.
3. Provide a clearance of approximately 13 mm (1/2 inch) at masonry or concrete at walls.

4. Apply plywood and structural-use panel subflooring with face grain or long dimension at right angles to the supports, with edges 6 mm (1/4 inch) apart at side joints, and 3 mm (1/8 inch) apart at end joints.
5. Combination subfloor-underlayment:
 - a. Space edges 3 mm (1/8 inch) apart.
 - b. Provide a clearance of 6 mm (1/4 inch) at masonry on concrete at walls.
6. Stagger panel end joints and make over support.

M. Underlayment:

1. Where finish flooring of different thickness is used in adjoining areas, provide underlayment of thickness required to bring finish-flooring surfaces into same plane.
2. Apply to dry, level, securely nailed, clean, wood subfloor without any projections.
3. Plywood and particle underlayment are to be glue-nailed to subfloor.
4. Butt underlayment panels to a light contact with a 1 mm (1/32 inch) space between plywood or hardboard underlayment panels and walls, and approximately 9 mm (3/8 inch) between particleboard underlayment panels and walls.
5. Stagger underlayment panel end joints with respect to each other and offset joints with respect to joints in the subfloor at least 50 mm (2 inches).
6. After installation, avoid traffic on underlayment and damage to the finish surface.

N. Sheathing:

1. Provide plywood or structural-use panels for sheathing.
2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
3. Set nails not less than 9 mm (3/8 inch) from edges.
4. Install 50 mm by 101 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.
- //5. Match and align sheathing which is an extension of work in place to existing. //

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SECTION 06 16 00 - SHEATHING

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. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Building paper.
 - 4. Building wrap.
 - 5. Sheathing joint-and-penetration treatment.
 - 6. Flexible flashing at openings in sheathing.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry" for plywood backing panels.

1.3 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
 - 6. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.
4. Building wrap.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

- B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

1. Plywood.
2. Oriented strand board.
3. Fiberboard wall sheathing.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
- B. Oriented Strand Board: DOC PS 2.
- C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- D. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA C9.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction.

- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Comply with performance requirements in AWP C27.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Use Exterior type for exterior locations and where indicated.
 - 3. Use Interior Type A, High Temperature (HT) for roof sheathing and where indicated.
 - 4. Use Interior Type A, unless otherwise indicated.
- B. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Application: Treat plywood indicated on Drawings, and the following:
 - 1. Roof and wall sheathing within 48 inches of fire walls.

2.4 WALL SHEATHING

- A. Plywood Wall Sheathing: Exterior Exposure 1, sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: Not less than 5/8 inch.
- B. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: Not less than 5/8 inch.
- C. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - 1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corporation.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches for vertical installation.

2.5 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exposure 1, sheathing.
 - 1. Span Rating: Not less than 16/0.

2. Nominal Thickness: Not less than 5/8 inch.

B. Oriented-Strand-Board Roof Sheathing: Exposure 1 sheathing.

1. Span Rating: Not less than 16/0.
2. Nominal Thickness: Not less than 5/8 inch.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

2.7 WEATHER-RESISTANT SHEATHING PAPER

A. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.

B. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.
 - b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
 - c. Ludlow Coated Products; Barricade Building Wrap.
 - d. Pactiv, Inc.; GreenGuard Classic Wrap.
 - e. Raven Industries Inc.; Rufco-Wrap.
 - f. Reemay, Inc.; Typar HouseWrap.
 - g. Approved Product.
3. Water-Vapor Permeance: Not less than 200 g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
 4. Allowable UV Exposure Time: Not less than three months.
- C. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants."
- B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

2.9 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.025 inch.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Plus Self-Adhered Flashing, Vycor V40 Weather Barrier Strips.
 - c. MFM Building Products Corp.; Window Wrap.
 - d. Polyguard Products, Inc.; Polyguard 300.

- e. Protecto Wrap Company; BT-20 XL or PS-45.
 - f. Approved Product.
- C. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."
 - 4. Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code."
 - 5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."
 - 6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
 - 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."
- D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with screws.
 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 3. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

3.3 SHEATHING JOINT-AND-PENETRATION TREATMENT

- A. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
 3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.4 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
1. Prime substrates as recommended by flashing manufacturer.
 2. Lap seams and junctures with other materials at least, except that at flashing flanges of other construction, laps need not exceed flange width.
 3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
 4. Lap weather-resistant building paper over flashing at heads of openings.

5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.5 PROTECTION

- A. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

END OF SECTION 06 16 00

SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior millwork for family prayer rooms (chapel) in hospitals.
- B. Items specified:
 - 1. Seats and benches.
 - 2. Counter Shelf.
 - 3. Counter or Work Tops.
 - 4. Pegboard (Perforated Hardboard).
 - 5. Mounting Strips, Shelves, and Rods.
 - 6. Moldings and Staff Beads.
 - 7. Base.
 - 8. Wood Bumpers.

1.2 RELATED REQUIREMENTS

- A. Woodwork Finish and Color: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Fabricated Metal brackets, bench supports and countertop legs: Section 05 50 00, METAL FABRICATIONS.
- C. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.
- D. Wood doors: Section 08 14 00, WOOD DOORS.
- E. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- F. Other Countertops: Division 11, EQUIPMENT and Division 12, FURNISHINGS.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International:
 - 1. A36/A36M-14 - Carbon Structural Steel.
 - 2. A53/A53M-12 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
 - 3. A240/A240M-15b - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - 4. B26/B26M-14e1 - Aluminum-Alloy Sand Castings.
 - 5. B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 6. E84-15b - Surface Burning Characteristics of Building Materials.
- C. American Hardboard Association (AHA):
 - 1. A135.4-04 - Basic Hardboard.

- D. Architectural Woodwork Institute (AWI):
 - 1. AWI-09 - Architectural Woodwork Quality Standards and Quality Certification Program.
- E. Builders Hardware Manufacturers Association (BHMA):
 - 1. A156.9-10 - Cabinet Hardware.
 - 2. A156.11-14 - Cabinet Locks.
 - 3. A156.16-13 - Auxiliary Hardware.
- F. Federal Specifications (Fed. Spec.):
 - 1. A-A-1922A - Shield Expansion (Calking Anchors, Single Lead).
 - 2. A-A-1936A - Adhesive, Contact, Neoprene Rubber.
 - 3. FF-N-836E- Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding.
 - 4. FF-S-111D(1) - Screw, Wood (Notice 1 inactive for new design).
 - 5. MM-L-736C(1) - Lumber, Hardwood.
- G. Hardwood Plywood and Veneer Association (HPVA):
 - 1. HP1-09 - Hardwood and Decorative Plywood.
- H. Military Specification (Mil. Spec):
 - 1. MIL-L-19140E - Lumber and Plywood, Fire-Retardant Treated.
- I. National Particleboard Association (NPA):
 - 1. A208.1-09 - Wood Particleboard.
- J. National Electrical Manufacturers Association (NEMA):
 - 1. LD 3-05 - High-Pressure Decorative Laminates.
- K. U.S. Department of Commerce, Product Standard (PS):
 - 1. PS1-07 - Construction and Industrial Plywood.
 - 2. PS20-10 - American Softwood Lumber Standard.

1.4 PREINSTALLATION MEETINGS

- A. Conduct pre-installation meeting at project site minimum 30 days before beginning Work of this section.
 - 1. Required Participants:
 - a. Owner's Representative.
 - b. Architect/Engineer.
 - c. Contractor.
 - d. Installer.
 - 2. Meeting Agenda: Installer to distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.

- d. Protection before, during, and after installation.
- e. Installation.
- f. Terminations.
- g. Transitions and connections to other work.
- h. Other items affecting successful completion.
- 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
 - 2. Millwork items - Half full size scale for sections and details 1: 50 (1/4 inch) for elevations and plans.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - a. Finish hardware.
 - b. Sinks with fittings.
 - c. Electrical components.
 - 2. List of acceptable sealers for fire retardant materials.
 - 3. Installation instructions.
- D. Samples:
 - 1. Plastic Laminate Finished Plywood and Particleboard: 150 mm by 300 mm (6 by 12 inches) long, each type and color.
 - a. Submit quantity required to show full color and texture range.
 - 2. Approved samples may be incorporated into work.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications:
 - 1. Regularly fabricates specified products.
 - 2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
- B. Installer Qualifications:
 - 1. Regularly installs specified products.
 - 2. Installed specified products with satisfactory service on five similar installations for minimum five years.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original sealed packaging.

- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, // color, // production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.
- D. Store products indoors in dry, weathertight, conditioned facility.
- E. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment:
 - 1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
 - 2. Work Area Ambient Conditions: HVAC systems are complete, operational, and maintaining facility design operating conditions continuously, beginning 48 hours before installation until Government occupancy.
 - 3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.
 - 4. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.
- B. Field Measurements: Verify field conditions affecting fabrication and installation. Show field measurements on Submittal Drawings.
 - 1. Coordinate field measurement and fabrication schedule to avoid delay.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

2.2 MATERIALS

- A. Grading and Marking: Factory mark with grade stamp lumber and plywood of inspection agency approved by the Board of Review, American Lumber Standard Committee.
- B. Lumber:
 - 1. Sizes:

- a. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes within manufacturing tolerances allowed by the standard under which product is produced.
 - b. Millwork, standing and running trim, and rails: Actual size as shown or specified.
 - 2. Hardwood: MM-L-736, species as specified for each item.
 - 3. Softwood: PS-20, exposed to view appearance grades:
 - a. Use C select or D select, vertical grain for transparent finish including stain transparent finish.
 - b. Use Prime for painted or opaque finish.
 - 4. Use edge grain Wood members exposed to weather.
 - 5. Moisture Content:
 - a. 32 mm (1-1/4 inches) or less nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
 - b. Other materials: According to standards under which the products are produced.
 - 6. Fire Retardant Treatment: Mil. Spec. MIL-L-19140E.
 - a. Treatment and performance inspection by an independent and qualified testing agency that establishes performance ratings.
 - b. Each piece of treated material bear identification of the testing agency and indicate performance according to such rating of flame spread and smoke developed.
 - c. Treat wood for maximum flame spread of 25 and smoke developed of 25.
 - d. Fire Resistant Softwood Plywood:
 - 1) Grade A, Exterior, plywood for treatment.
 - 2) Surface Burning Characteristics: When tested according to ASTM E84.
 - a) Flame spread: 0 to 25.
 - b) Smoke developed: 100 maximum.
 - e. Fire Resistant Hardwood Plywood:
 - 1) Core: Fire retardant treated softwood plywood.
 - 2) Hardwood face and back veneers untreated.
 - 3) Factory seal panel edges.
- C. Plywood:
- 1. Softwood Plywood: DOC PS1.

- a. Plywood, 13 mm (1/2 inch) and thicker; minimum five ply construction, except 32 mm (1-1/4 inch) thick plywood minimum seven ply.
 - b. Plastic Laminate Plywood Cores:
 - 1) Exterior Type, and species group.
 - 2) Veneer Grade: A-C.
 - c. Shelving Plywood:
 - 1) Interior Type, any species group.
 - 2) Veneer Grade: A-B or B-C.
 - d. Other: As specified for item.
2. Hardwood Plywood: HPVA: HP.1.
- a. Species of Face Veneer: As shown or as specified with each particular item.
 - b. Grade:
 - 1) Transparent Finish: Type II (interior) A grade veneer.
 - 2) Paint Finish: Type II (interior) Sound Grade veneer.
 - c. Species and Cut: Plain sliced red oak // rotary cut white birch // unless specified otherwise.
- D. Particleboard: NPA A208.1, Type 1, Grade 1-M-3.
- 1. Plastic Laminate Particleboard Cores:
 - a. Type 1, Grade 1-M-3, // Type 2, Grade 2-M-2, unless otherwise specified.
 - b. Type 2, Grade 2-M-2, exterior bond, for tops with sinks.
- E. Building Board (Hardboard):
- 1. ANSI/AHA A135.4, 6 mm (1/4 inch) thick unless specified otherwise.
 - 2. Perforated hardboard (Pegboard): Type 1, Tempered perforated 6 mm (1/4 inch) diameter holes, on 25 mm (1 inch) centers each way, smooth surface one side.
- F. Plastic Laminate: NEMA LD-3.
- 1. Exposed Laminate Surfaces including Countertops, benches and Sides of Cabinet Doors: Grade HGL.
 - 2. Cabinet Interiors including Shelving: NEMA, CLS as a minimum, with the following:
 - a. Plastic laminate clad plywood or particle board.
 - b. Resin impregnated decorative paper thermally fused to particle board.
 - 3. Plastic Laminate Covered Wood Tops Backing: Grade HGP.
 - 4. Postformed Surfaces: Grade HGP.

- G. Stainless Steel: ASTM A240, Type 302 or 304.
- H. Cast Aluminum: ASTM B26.
- I. Extruded Aluminum: ASTM B221.

2.3 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer.

2.4 FABRICATION

- A. General:
 - 1. AWI Custom Grade for interior millwork.
 - 2. Finish woodwork, free from pitch pockets.
 - 3. Trim, standard stock molding and members of same species, except where special profiles are shown.
 - 4. Plywood, minimum 13 mm (1/2 inch), unless otherwise shown on Drawings or specified.
 - 5. Edges of members in contact with concrete or masonry having a square corner caulking rebate.
 - 6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
 - 7. Fabricate interior trim and items of millwork to be painted from jointed, built-up, or laminated members, unless otherwise shown on Drawings or specified.
 - 8. Plastic Laminate Work:
 - a. Factory glued to either a plywood or a particle board core, thickness as shown on Drawings or specified.
 - b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown on drawings or specified. Use plastic molded edge strips on 19 mm (3/4 inch) thick or thinner core material.
 - c. Provide plastic backing sheet on underside of countertops, vanity tops, thru-wall counter // and sills // including back splashes and end splashes of countertops.
 - d. Use backing sheet on concealed large panel surface when decorative face does not occur.
- B. Seats and Benches:
 - 1. Fabricate from 50 mm (2 inch) stock strips of plain-sawed White Oak, or Maple.

2. Solid seats securely glued together of spliced, doweled, or double tongued and grooved wood pieces. Where open joints are indicated, work each wood piece from solid stock.

3. Round top edges and corners where exposed.

C. Mounting Strips, Shelves and Rods:

1. Cut mounting strips from softwood stocks, 25 mm by 100 mm (1 by 4 inches), exposed edge slightly rounded.
2. Cut wood shelf from softwood 1 inch stock, of width shown, exposed edge slightly rounded.
 - a. Option: Provide 19 mm (3/4 inch) thick plywood with 19 mm (3/4 inch) softwood edge nosing on exposed edge, slightly rounded.
3. Plastic laminate cover, 19 mm (3/4 inch) thick plywood or particle board core with plastic molded edge and end strips. Size, finish and number as shown on Drawings.

D. Pegboard:

1. Perforated hardboard sheet size as shown on Drawings.
2. Spacing strip: 13 mm by 13 mm (1/2 by 1/2 inch); glued to hardboard sheet.
 - a. Locate at perimeter of sheet edge.
 - b. Locate material intermediate spacing strips at 800 mm (32 inches)o.c.
3. Cover exposed edge with 19 mm (3/4 inch) one quarter round edge trim and finish flush with hardboard surface. Glue to spacing strip and hard board.

E. Plastic Laminate Counter or Work Tops:

1. Thickness: 32 mm (1-1/4 inch) thick core unless shown otherwise.
 - a. Edges:
 - 1) Decorative laminate for exposed edges of tops, back, and endsplash, 38 mm (1-1/2 inches) wide.
 - 2) Plastic or metal edges for top edges less than 38 mm (1-1/2 inches) wide.
 - b. Assemble backsplash and end splash to counter top.
 - c. Use one piece counters for straight runs.
 - d. Miter corners for field joints with overlapping blocking on underside of joint.
2. Fabricate wood counter for work benches as shown on Drawings.

F. Wood Handrails:

1. AWI Premium Grade.
2. Species: Maple or Birch.
3. Fabricate in one piece and one length when practical.
4. Fabricate curved sections for ends of rails to return to wall and where rails change slope or direction.
5. Joints are permitted only where rail changes direction or slope, or where necessary for field erection or shipping.
6. Scarf or dowel all joints to provide a smooth and rigid connection. Glue all joints.
7. Fit joints, to produce a hair-line crack.
8. Completely shop fabricated according to approved shop drawings.

2.5 ACCESSORIES

A. Hardware:

1. Rough Hardware:
 - a. Provide rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric-galvanizing process. Galvanized where specified.
 - b. Fasteners:
 - 1) Bolts with Nuts: FF-N-836.
 - 2) Expansion Bolts: A-A-1922A.
 - 3) Screws: Fed. Spec. FF-S-111.
2. Finish Hardware:
 - a. Cabinet Hardware: ANSI A156.9.
 - 1) Door/Drawer Pulls: B02011. Door in seismic zones: B03182.
 - 2) Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm (3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep.
 - 3) Sliding Door Tracks: B07063.
 - 4) Adjustable Shelf Standards: B4061 with shelf rest B04083.
 - 5) Concealed Hinges: B1601, minimum 110 degree opening.
 - 6) Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
 - 7) Cabinet Door Catch: B0371 or B03172.
 - 8) Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.
 - b. Cabinet Locks: ANSI A156.11.
 - 1) Drawers and Hinged Door: E07262.

- 2) Sliding Door: E07162.
- c. Auxiliary Hardware: ANSI A156.16.
 - 1) Shelf Bracket: B04041, japanned or enameled finish.
 - 2) Handrail Brackets: L03081 or L03101.
 - a) Cast Aluminum, satin polished finish.
 - b) Cast Malleable Iron, japanned or enamel finish.
- d. Steel Channel Frame and Leg supports for Counter top. Fabricated under Section 05 50 00, METAL FABRICATIONS.
- e. Pipe Bench Supports:
 - 1) Pipe: ASTM A53.
- f. Fabricated Wall Bench Supports:
 - 1) Steel Angles: ASTM A36 steel with chrome finish, or ASTM A167, stainless steel with countersunk wood screws, holes at 64 mm (2-1/2 inches) on center on horizontal member.
 - 2) Use 38 mm by 38 mm by 5 mm (1-1/2 by 1-1/2 by 3/16 inch) angle thick drilled for screw and bolt holes unless shown otherwise. Drill 6 mm (1/4 inch) holes for anchors on vertical member, maximum 200 mm (8 inches) on center between ends or corners.
 - 3) Stainless Steel Bars Brackets: ASTM A167, fabricated to shapes shown on Drawings, Number 4 finish. Provide 50 mm by 5 mm (2 inch by 3/16 inch) bars unless shown otherwise. Drill for anchors and screws. Drill countersunk wood screw holes at 64 mm (2-1/2 inches) on center on horizontal members and minimum two 13 mm (1/4 inch) hole for anchors on vertical member.
- g. Thru-Wall Counter Brackets:
 - 1) Steel angles drilled for fasteners on 100 mm (4 inches) centers.
 - 2) Baked enamel prime coat finish.
- h. Rubber or Vinyl molding:
 - 1) Rubber or vinyl standard stock and in longest lengths practicable.
 - 2) Design for closures at joints with walls and adhesive anchorage.
 - 3) Adhesive as recommended by molding manufacturer.
- i. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

B. Adhesive:

1. Plastic Laminate: Fed. Spec. A-A-1936.
2. Interior Millwork: Unextended urea resin, unextended melamine resin, phenol resin, or resorcinol resin.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION

A. Installation:

1. Prime millwork receiving transparent finish and back-paint concealed surfaces.
2. Fasten trim with fine finishing nails, screws, or glue as required.
3. Set nails for putty stopping. Provide washers under bolt heads where no other bearing plate occurs.
4. Seal cut edges of fire retardant treated wood materials with a certified acceptable sealer.
5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
6. Plumb and level items unless shown otherwise.
7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.

B. Seats and Benches:

1. Provide stainless steel countersunk screws to secure wood seats to brackets, angle, or pipe supports.
2. Provide stainless steel or chrome plated steel bolts for anchorage to walls. Use 6 mm (1/4 inch) toggle bolts in steel stud walls and hollow masonry. Use 6 mm (1/4 inch) expansion bolts in solid masonry or concrete.
3. Wall Benches: Fasten wall benches on stainless steel bar brackets, 150 mm (6 inches) near ends and maximum 900 mm (3 feet) on centers.
4. Freestanding Benches: Provide pipe bench support within 200 mm (8 inches) of ends and maximum 900 mm (3 feet) on centers.

C. Pegboard or Perforated Hardboard:

1. Install board with chromium plated steel round-head toggle bolts or other fasteners capable of supporting board when loaded at 122 kg/sq. m (25 psf) of board.
2. Install board with spacers to allow insertion and removal of hooks and accessories.
3. Install round trim, 6 mm (1/4 inch) at perimeter to finish flush with face of board and close space between wall and hardboard.

D. Shelves:

1. Install mounting strip at back wall and end wall for shelves in closets where shown secured with toggle bolts at each end, not over 600 mm (24 inch) centers between ends.
 - a. Nail Shelf to mounting strip at ends and to back wall strip at not over 900 mm (36 inches) on center.
 - b. Install metal bracket, ANSI A156.16, B04041, not over 1200 mm (4 feet) centers when shelves exceed 1800 mm (6 feet) in length.
 - c. Install metal bracket, ANSI A156.16, B04051, not over 1200 mm (4 feet) on centers where shelf length exceeds 1800 mm (6 feet) in length with metal rods, clothes hanger bars ANSI A156.16, L03131, of required length, full length of shelf.
2. Install vertical slotted shelf standards to studs with toggle bolts through each fastener opening. Double slotted shelf standards is acceptable where adjacent shelves terminate.
 - a. Install brackets providing supports for shelf not over 900 mm (36 inches) on center and within 13 mm (1/2 inch) of shelf end unless shown otherwise.
 - b. Install shelves on brackets so front edge is restrained by bracket.

E. Handrails:

1. Install in one piece and one length when practical.
2. Where rails change slope or direction, install special curved sections and ends of rails to return to wall, glue all field joints.
3. Secure rails with wood screws at 450 mm (18 inches) on centers to metal balustrades top rail.
4. Install brackets within 300 mm (12 inches) of ends of handrails and at every spaced intervals between not exceeding 1500 mm (5 feet) on centers at intervals between as shown. Anchor brackets as detailed and rails to brackets with screws.

5. Install new segments where new construction creates discontinuous conditions. Match existing, adjacent rails.

F. Install with butt joints in straight runs and miter at corners.

3.3 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed surfaces. Remove contaminants and stains.

C. Touch up damaged factory finishes.

1. Repair painted surfaces with touch up primer.

3.4 PROTECTION

A. Protect finish carpentry from traffic and construction operations.

B. Cover finish carpentry with reinforced kraft paper, and plywood or hardboard.

C. Remove protective materials immediately before acceptance.

D. Repair damage.

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SECTION 071300 – SHEET WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Self adhesive modified bitumen sheet waterproofing.

1.2 RELATED SECTIONS

- A. Section 07132: Self adhesive modified bitumen sheet used as waterproof underlayment and flexible flashing.

1.3 SYSTEM PERFORMANCE

- A. Provide waterproofing installations that form watertight continuous membranes that prevent passage of water under hydrostatic pressure.

1.4 SUBMITTALS – ACTION

- A. Comply with requirements of Section 01330.
- B. Product Data: Sheet waterproofing and accessories.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced with specified products and acceptable to manufacturer of waterproofing membrane.

1.6 DELIVERY, STORAGE, HANDLING

- A. Comply with requirements of Section 01600.

1.7 PROJECT CONDITIONS

- A. Substrate: Proceed with work only after substrate construction, openings, and penetrations have been completed.
- B. Weather: Proceed with waterproofing and associated work only when existing and forecast weather conditions will permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

PART 2 PRODUCTS

2.1 MATERIALS – RUBBERIZED ASPHALT SHEET WATERPROOFING

- A. Waterproofing Membrane: Self-adhering, self-healing membrane of rubberized asphalt integrally bonded to polyethylene sheeting, formed into flexible sheets 60 mils thick.
 - 1. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
 - 2. Grace, W. R. & Co.; Bituthene 3000/4000.

3. Meadows, W. R., Inc.; SealTight Mel-Rol.
 4. Pecora Corporation; Duramem 700-SM.
 5. Polyguard Products; Polyguard 650.
- B. Flashing Accessories, Primer: As recommended by waterproofing membrane manufacturer for Project applications.
- C. Protection Boards: As recommended by waterproofing membrane manufacturer for Project applications.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that concrete substrates have cured minimum 28 days and that moisture content is within limits recommended by waterproofing membrane manufacturer.

3.2 PREPARATION

- A. Comply with manufacturer recommendations.
- B. Foundation Surfaces: Chip off projections, fill large voids, remove loose materials.
- C. Apply primer to concrete and masonry surfaces at recommended rates. Prime only area which will be covered by waterproofing membrane in same working day; reprime areas not covered by waterproofing membrane within 24 hours.

3.3 INSTALLATION

- A. Comply with requirements of Section 01700.
- B. Coordinate installation of waterproof membrane with other construction to ensure protection of building.
- C. Schedule installation to minimize period of exposure of sheet waterproofing materials.
- D. Extend waterproofing sheets and flashings as shown to provide complete membrane over area indicated to be waterproofed.
- E. Bond membrane to vertical surfaces and to horizontal surfaces where shown or recommended by manufacturer.
- F. Seal membrane watertight to projections through membrane.
- G. Seal seams watertight.
- H. Seal exposed termination edges watertight.

3.4 PROTECTION

- A. Install protection boards over completed membrane. Protection boards are not required where membrane is covered with foundation insulation.

- B. Protect completed membrane during installation of work over membrane and throughout remainder of construction period.
- C. Do not allow traffic of any type on unprotected membrane.

END OF SECTION

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SECTION 07210 – BUILDING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Foundation and slab perimeter insulation.
- B. Concealed building insulations.
- C. Loose-fill insulation, pneumatically placed.

1.2 RELATED SECTIONS

- A. Section 07216: Spray-applied foam plastic insulation.
- B. Section 07217: Spray-applied glass fiber insulation.
- C. Section 07531: Insulation for membrane roofing.
- D. Section 07842: Safing insulation in fire-resistive joints.
- E. Section 09820: Acoustic insulation.

1.3 SUBMITTALS – ACTION

- A. Comply with requirements of Section 01330.
- B. Product Data: Each type of insulation.

1.4 QUALITY ASSURANCE

- A. Thermal Resistivity: Required R-values are for values determined at 75 deg F.
- B. Fire-Test Response Characteristics: Provide insulation and related materials with fire-test response characteristics determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction. Unless noted otherwise, required fire performance characteristics apply to facings as well as base insulation material.
 - 1. Surface Burning Characteristics: ASTM E84.
 - 2. Fire Resistance Ratings: ASTM E119.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01600.
- B. Protect insulations from physical damage and deterioration, including loss of insulating or other characteristics.
- C. Protect insulations from becoming wet, soiled, or covered with ice or snow.

PART 2 PRODUCTS

2.1 MATERIALS – INSULATIONS

- A. Thicknesses: Furnish insulations in thicknesses indicated or as needed to provide indicated R-value.
- B. Foundation Insulation: Extruded polystyrene boards; ASTM C578, Type X, 15 psi minimum compressive strength. At Contractor's option, Type IV extruded polystyrene boards may be used instead of Type X.
 - 1. Acceptable Products:
 - a. Styrofoam Gray Board; Dow Chemical USA
 - b. Foamular 150; Owens-Corning
- C. Slab Perimeter Insulation: Extruded polystyrene boards; ASTM C578, Type IV, 25 psi minimum compressive strength.
 - 1. Flame Spread: Maximum 25.
 - 2. Smoke Developed: Maximum 180.
 - 3. Acceptable Products:
 - a. Styrofoam SM or SB; Dow Chemical USA
 - b. Foamular 250; Owens-Corning
- D. Rigid Wall Insulation: Extruded polystyrene boards; ASTM C578, Type IV, 25 psi minimum compressive strength.
 - 1. Flame Spread: Maximum 25.
 - 2. Smoke Developed: Maximum 180.
 - 3. Acceptable Products:
 - a. Styrofoam SM or SB; Dow Chemical USA
 - b. Foamular 250; Owens-Corning
- E. Batt Insulation: Mineral fibers with thermosetting resin binders; ASTM C665, Class A blankets.
 - 1. Mineral Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
 - 2. Flame Spread: Maximum 25.
 - 3. Smoke Developed: Maximum 50.
 - 4. Unit Size: Use widths that fill framing spaces.
 - 5. Facing: Type I unfaced except supply Type II with kraft paper facing where indicated.
- F. Glass-Fiber Loose-Fill Insulation: ASTM C764, Type I for pneumatic application; maximum flame-spread and smoke-developed indexes of 5.

2.2 ACCESSORIES

- A. Adhesive for Bonding Insulation: Type recommended by insulation manufacturer, and conforming to requirements for fire-test response characteristics of insulation.
- B. Crack Sealer: Type recommended by insulation manufacturer for bonding edge joints between units and filling voids in work.

-
- C. Eave Ventilation Troughs: Manufactured rigid, non-combustible sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove projections and sharp edges that might puncture or tear insulation facings. Remove projections that interfere with placement of insulation.

3.2 INSTALLATION – GENERAL

- A. Comply with requirements of Section 01700.
- B. Install insulation that is undamaged, dry, unsoiled, and has not been left exposed at any time to ice, snow, or rain.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated.
- D. Cut and fit insulation closely to adjacent insulation units, surrounding construction, penetrations, and obstructions. Remove projections that interfere with placement.
- E. Provide noncorrosive impaling pins, wires, or other mechanical anchorage or support as needed to maintain insulation permanently in place. Where impaling pins are exposed to human contact, provide protective caps.
- F. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- G. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION – FOUNDATION AND SLAB PERIMETER INSULATION

- A. Vertical Surfaces: Set insulation in adhesive that will not damage waterproofing membrane.
- B. Horizontal Surfaces: Lay insulation boards with butt joints; stagger end joints.
- C. Set boards with edges of adjacent boards butted in full contact, and maximum 3/16 inch joints at penetrations and perimeter.
- D. Fill voids, cracks, and joints wider than 3/16 inch with crack sealer or with strips cut from boards and wedged in place.
- E. Secure boards against displacement during backfilling and concrete placement.
- F. Where insulation is turned up at slab edges, score boards nearly through to facilitate removal to correct depth for later installation of sealant.
- G. Rigid Insulation:

1. Set boards with edges in contact. Limit width of joints between boards and penetrations or adjacent construction at terminations to 3/16 inch.
2. Install insulation boards with adhesive or mechanical fasteners that will maintain insulation in place until screw-anchored protective covering construction is installed.

3.4 INSTALLATION – BATT INSULATION

- A. Friction fit batt insulation into framing spaces. Provide wires or impaling pins as needed to secure batts against settlement and other displacement.
- B. Where faced units are indicated, tape facing to framing and adjacent construction at terminations.
- C. Stuff tufts of unfaced batt insulation into miscellaneous voids and cavities as indicated or as needed to complete thermal envelope. Compact insulation to approximately 40 percent of normal volume.

3.5 INSTALLATION – LOOSE-FILL INSULATION

- A. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves. Secure troughs to framing members. Extend troughs high enough to prevent displacement of loose-fill insulation into eave cavities.
- B. Place loose-fill insulation into spaces indicated by machine blowing method to comply with ASTM C1015. Level horizontal applications to uniform thickness indicated and lightly settle to uniform density, but do not compact excessively.

3.6 CLEANING

- A. Remove misapplications, spills, and displacements of loose insulation from ventilation spaces and other areas.
- B. Remove misapplications and spills of adhesive from exposed surfaces.

3.7 PROTECTION

- A. Protect installed insulation from harmful weather exposures, from water absorption, and from physical abuse.
- B. Provide temporary coverings or enclosures where installation of concealing work is delayed.
- C. Protect foundation insulation from damage and displacement during backfilling and concrete placement.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Perimeter insulation under slabs-on-grade.
 - 2. Perimeter wall insulation (supporting backfill).
 - 3. Concealed building insulation.
 - 4. Vapor retarders.
 - 5. Sound attenuation insulation.
- B. Related Sections include the following:
 - 1. Division 06 Section "Sheathing" for foam-plastic board sheathing over wood framing.
 - 2. Division 07 Section "Cold Fluid-Applied Waterproofing" for insulation and insulated drainage panels installed with waterproofing.
 - 3. Division 07 Section "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing for insulation specified as part of roofing construction.
 - 4. Division 09 Section "Gypsum Board" for installation in metal-framed assemblies of insulation specified by referencing this Section.
 - 5. Division 21 Section "Fire-Suppression Systems Insulation."
 - 6. Division 22 Section "Plumbing Insulation."
 - 7. Division 23 Section "HVAC Insulation."
 - 8. Division 33 Section "Subdrainage" for insulated drainage panels.

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.

1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.
- D. Research/Evaluation Reports: For foam-plastic insulation.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 1. Surface-Burning Characteristics: ASTM E 84.
 2. Fire-Resistance Ratings: ASTM E 119.
 3. Combustion Characteristics: ASTM E 136.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
1. Manufacturers:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Pactiv Building Products Division.
 - e. Approved Manufacturer.
 2. Type VI, 1.80 lb/cu. ft., unless otherwise indicated.
- B. Extruded-Polystyrene Drainage Panels: ASTM C 578, of type and density indicated below and fabricated with one side having a matrix of drainage and edge channels.
1. Manufacturers:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Approved Manufacturer.
 2. Type VI, 1.80 lb/cu. ft.

2.3 GLASS-FIBER BOARD INSULATION

- A. Manufacturers:
1. CertainTeed Corporation.
 2. Johns Manville.
 3. Knauf Fiber Glass.
 4. Owens Corning.
 5. Approved Manufacturer.

- B. Foil-Faced, Flexible Glass-Fiber Board Insulation: ASTM C 612, Type IA or ASTM C 553, Types I, II, and III; faced on 1 side with foil-scrim-kraft vapor retarder; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and of the following nominal density and thermal resistivity:
 - 1. Nominal density of 1.0 lb/cu. ft. , thermal resistivity of 3.7 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.4 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers:
 - 1. CertainTeed Corporation.
 - 2. Guardian Fiberglass, Inc.
 - 3. Johns Manville.
 - 4. Knauf Fiber Glass.
 - 5. Owens Corning.
 - 6. Approved Manufacturer.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- C. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
 - 1. 3-1/2 inches thick with a thermal resistance of 13 deg F x h x sq. ft./Btu at 75 deg F.
 - 2. 5-1/2 inches (140 mm) thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F.

2.5 RADIANT BARRIERS

- A. Sheet Radiant Barriers: ASTM C 1313 and as follows:
 - 1. Products:
 - a. Innovative Energy, Inc.; R+Heatshield Commercial Solid.
 - b. Innovative Insulation, Inc.; Super R Premium (Commercial).
 - c. Approved Product.
 - 2. Sheet Construction: For adherence to existing glass, color to match window frames.
 - 3. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes of 5 and 10, respectively.
 - 4. Tear Resistance: Manufacturer's standard.
 - 5. Water-Vapor Transmission: 1 perm, maximum.
 - 6. Sheet Width: 48"

2.6 VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 8 mils thick, with maximum permeance rating of 0.13 perm.
- B. Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating of 0.0507 perm.
 - 1. Products:
 - a. Raven Industries Inc.; DURA-SKRIM 6WW.
 - b. Reef Industries, Inc.; Griffolyn T-65.
 - c. Approved Product.
- C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- D. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- E. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.
- F. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

2.7 AUXILIARY INSULATING MATERIALS

- A. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

- A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.
- D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

- C. Set vapor-retarder-faced units with vapor retarder to warm-in-winter side of construction, unless otherwise indicated.
 - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 6. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
 - b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- E. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 - 2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
 - 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
 - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Install 3-inch- thick, unfaced glass-fiber blanket insulation over suspended ceilings at partitions in a width that extends insulation 48 inches on either side of partition.

3.7 INSTALLATION OF RADIANT BARRIERS

- A. Install sheet radiant barriers in locations indicated according to ASTM C 1158.

3.8 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
- C. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- D. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.9 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

07 21 60 – SPRAY-APPLIED FOAM PLASTIC INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Spray-applied polyurethane insulation in concealed framing spaces and other exterior wall cavities.

1.2 RELATED SECTIONS

- A. Section 07210: Rigid and batt insulation.

1.3 SUBMITTALS – ACTION

- A. Comply with requirements of Section 01330.
- B. Product Data: Spray-applied foam plastic insulation.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Specialty firm with minimum 3 years experience in application of specified products and approved by manufacturer.
- B. Regulatory Requirements: Verification of surface burning characteristics by testing per ASTM E84 by UL or other testing agency acceptable to authorities having jurisdiction.
- C. Provide copies of model code evaluation reports to authorities having jurisdiction if requested.
- D. Field Sample: Provide sample application in one guest room to demonstrate density, cohesion, and other characteristics of finished Work. Acceptable field sample may remain as part of the Work and shall serve as comparison standard for the remaining installation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01600.
- B. Protect liquid materials from freezing.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements: Comply with manufacturer recommendations for temperature and humidity limitations.
- B. Do not apply spray foam over snow, ice, liquid water, or moisture in any form.

1.7 SEQUENCING AND COORDINATION

- A. Apply sprayed insulation after all items directly attached to or penetrating substrate are in place.

- B. Apply insulation after mechanical and electrical work in affected walls are complete and ready to be concealed.
- C. Coordinate installation of sprayed insulation with exterior wall framing so that box headers and other concealed voids in exterior walls are filled with insulation.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Spray Polyurethane Foam Insulation: Two-component system for spray-applied foamed-in-place, closed-cell, self-supporting thermal insulation.
 - 1. Density: Nominal 2 lb per cubic foot.
 - 2. Compressive Strength: 22 psi when measured 60 minutes after application.
 - 3. R-Value, Aged: Minimum 6.8 per inch when tested per ASTM C518.
 - 4. Flame Spread: Less than 75 when tested per ASTM E84.
 - 5. Smoke Developed Index: Less than 450 when tested per ASTM E84.
 - 6. Air Leakage: 0 when tested at 6.24 psf per ASTM E285.
 - 7. Vapor Transmission: 1.8 perms per inch.
- B. Manufacturers: Subject to compliance with requirements, provide products of one of the following manufacturers:
 - 1. North Carolina Foam Industries (NCFI); Mt Airy, NC; 800-346-8229.
 - 2. Approved equivalent.
- C. Primer, Substrate Preparation Materials: As recommended by manufacturer for Project applications.
- D. Where used for insulating perimeter shim spaces at doors, windows, and storefront framing, product specified above or other similar but specialized product for insulating small cavities in exterior wall may be used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that moisture on substrates and in cavities is within manufacturer's recommended limits.

3.2 PREPARATION

- A. Remove loose debris, construction waste, and other materials from cavities that receive spray insulation.
- B. Clean substrates of contaminants and incompatible substances that adversely affect foam formation, curing, or adhesion.
- C. Block off gaps or voids that would allow spray insulation to enter other cavities in wall construction.

- D. Mask and protect adjacent finished surfaces from over-spray and damage by spray application.
- E. Wrap electrical outlets and conduit in fiberglass insulation per Factory Mutual requirements.

3.3 APPLICATION

- A. Comply with requirements of Section 01700.
- B. Use only application equipment recommended by insulation manufacturer.
- C. Apply insulation to indicated cavities in exterior wall assemblies without voids or gaps.
 - 1. Apply foam to achieve maximum permitted thickness, as limited by flame spread and smoke developed Code limitations.
 - 2. Fill remaining cavities with spray-applied glass fiber insulation specified in Section 07217.
- D. Apply foam only to cavities that will be completely encapsulated by fire-resistant thermal barriers.
 - 1. Exception: Apply foam insulation to perimeter shim spaces for doors, windows, and storefront framing.
- E. Cut back projections and remove excess foam that would adversely affect application of enclosing construction, including causing bowing or distortion of interior gypsum board.
- F. Provide ventilation as needed to properly cure the insulation.

3.4 FIELD QUALITY CONTROL

- A. Comply with requirements of Section 01400.
- B. Take samples of foam at beginning of each day's work and after changing each set of foam components. Test samples to verify that density of foam is within plus or minus 10 percent of specified density.
 - 1. If samples indicate density below manufacturer's recommended limits, provide additional testing to verify foam density as requested by Owner's Representative without change to Contract Sum or Contract Time.
- C. Apply foam to fill areas removed for sampling.

3.5 CLEANING

- A. Remove spills, overspray, and misapplications immediately as they occur.

END OF SECTION

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07 27 26 FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fluid-applied, vapor-retarding membrane air barriers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Product test reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.2 VAPOR-RETARDING MEMBRANE AIR BARRIER

- A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: synthetic polymer membrane.
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. Synthetic Polymer Membrane:
 - 1) Grace, W. R., & Co. - Conn.; Perm-A-Barrier Liquid.
 - 2) Henry Company; Air-Bloc 32.
 - 3) Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight.
 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Maximum 0.1 perm (5.8 ng/Pa x s x sq. m); ASTM E 96/E 96M.
 - c. Ultimate Elongation: Minimum 500 percent; ASTM D 412, Die C.

2.3 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft (24- to 32-kg/cu. m) density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- C. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- B. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- C. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- D. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

3.2 INSTALLATION

- A. General: Install fluid-applied membrane air-barrier and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install air-barrier assembly on roofing membrane or base flashing so that a minimum of **3 inches (75 mm)** of coverage is achieved over each substrate.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of air barrier to substrate with termination mastic.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transitions and flashing so that a minimum of **3 inches (75 mm)** of coverage is achieved over each substrate. Maintain **3 inches (75 mm)** of full contact over firm bearing to perimeter frames with not less than **1 inch (25 mm)** of full contact.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal air-barrier assembly around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams. Slit and flatten fishmouths and blisters. Extend patches **6 inches (150 mm)** beyond repaired areas.
- K. Fluid-Applied Membrane Material: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Retarding Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than **40-mil (1.0-mm)** dry film thickness applied in one or more equal coats.

- L. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- M. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.3 FIELD QUALITY CONTROL

- A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.
- B. Air barriers will be considered defective if they do not pass tests and inspections.
 - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 - 2. Remove and replace deficient air-barrier components for retesting as specified above.
- C. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- D. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- E. Remove masking materials after installation.

END OF SECTION 072726

**SECTION 07311
ASPHALT SHINGLES**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Asphalt shingles.
 - 2. Felt underlayment.
 - 3. Self-adhering sheet underlayment.
 - 4. Ridge vents.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples: For asphalt shingles ridge and hip cap shingles, and ridge vent.
- C. Product test reports.
- D. Research/evaluation reports.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain ridge and hip cap shingles ridge vents, felt underlayment and self-adhering sheet underlayment through one source from a single asphalt shingle manufacturer.
- B. Fire-Test-Response Characteristics: Provide asphalt shingle and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.
- C. Preinstallation Conference: Conduct conference at Project site.

1.4 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials within specified warranty period.
 - 1. Material Warranty Period: 35 years from date of Substantial Completion, prorated, with first 3 years nonprorated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Three-Dimensional Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
1. Products:
 - a. Celotex Corporation
 - b. CertainTeed Corporation
 - c. Elk Corporation of Dallas
 - d. GAF Materials Corporation
 - e. Georgia-Pacific Corporation
 - f. Owens Corning
 2. Tab Arrangement: Three tab, regularly spaced.
 3. Design Basis : Color to match existing Elder Apartments.
- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt.

2.3 UNDERLAYMENT MATERIALS

- A. Felts: ASTM D 226, Type I, asphalt-saturated organic felts, nonperforated.
- B. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied.
- C. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0- mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied.

2.4 RIDGE VENTS

- A. Rigid Ridge Vent: Manufacturer's standard rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and with external deflector baffles; for use under ridge shingles.
1. Products:

- a. Air Vent Inc., a CertainTeed Company; ShingleVent II.
- b. Cor-A-Vent, Inc.; V-Series.
- c. GAF Materials Corporation; Cobra Rigid Vent II.
- d. Globe Building Materials, Inc.; SmartAir Ridge Vent.
- e. Lomanco, Inc.; OR-4.
- f. Mid-America Building Products; RidgeMaster Plus.
- g. Obdyke, Benjamin Incorporated; Xtractor Vent X18.
- h. Owens Corning; VentSure Ridge Vent.
- i. Ridglass Manufacturing Company, Inc.; Coolvent.
- j. Trimline Building Products; Trimline Ridge Vent.

2.5 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized steel wire shingle nails, minimum 0.120-inch- diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch- diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through plywood sheathing.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized steel wire with low profile capped heads or disc caps, 1-inch minimum diameter.

2.6 METAL FLASHING AND TRIM

- A. Sheet Metal Flashing and Trim: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
 - 1. Sheet Metal: Copper, Lead-coated copper, Stainless steel
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Single-Layer Felt Underlayment: Install single layer of felt underlayment on roof deck perpendicular to roof slope in parallel courses. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails.
 - 1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches in direction to shed water. Lap ends of felt not less than 6 inches over self-adhering sheet underlayment.

- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated, lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.

3.2 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
 - 1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

3.3 ASPHALT SHINGLE INSTALLATION

- A. Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip leave removed at least 7 inches wide with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 1/2 inch over fascia at eaves and rakes.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt shingle strips with a minimum of five roofing nails located according to manufacturer's written instructions.
- E. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

END OF SECTION 07311

**SECTION 07460
FIBER CEMENT SIDING**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiber-cement lap siding
- B. Fiber cement trim boards

1.2 RELATED SECTIONS

- A. Section 07270: Weather barrier behind siding.
- B. Section 07620: Sheet metal flashing.
- C. Section 07920: Joint sealants, paintable caulking.
- D. Section 09910: Paint finish for siding.

1.3 SUBMITTALS – ACTION

- A. Comply with requirements of Section 01330.
- B. Product Data:
 - 1. Lap siding.
 - 2. Trim boards
 - 3. Panels

1.4 QUALITY ASSURANCE

- A. Provide copies of model code evaluation reports if requested by authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01600.
- B. Store products on blocking and protect from moisture, soiling, and staining.
- C. Provide ventilation below waterproof covers.
- D. Remove products from packaging that has become soaked with water.

1.6 SEQUENCING

- A. Coordinate installation with flashings, weather barriers, and other adjoining construction to ensure proper sequencing for weathertight performance.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Design basis : Lap Siding: James Hardie “HardiePlank”.
 - 1. Surface: “Select Cedarmill”.

2. Exposure: to match existing, adjacent Anna John Nursing Home.
3. Sizes: As recommended by manufacturer for indicated exposure.
4. Finish: Factory primed and prepped for painting in the field.

2.2 ACCESSORIES

- A. Fasteners: Stainless steel or hot-dip galvanized steel screws and nails.
 1. Length: Sufficient length to fully penetrate metal studs or wood sheathing panels, as appropriate to installation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that wall sheathing is covered with weather barrier.

3.2 INSTALLATION

- A. Comply with requirements of Section 01700.
- B. Lap Siding: Install boards level, accurately aligned, and with uniform exposure.
 1. Install with 4-inch exposure unless noted otherwise.
 2. Stagger end joints between courses.
- C. Trim: Install trim level and plumb.
 1. Install with minimum number of joints possible, using full-length pieces where possible. Do not use pieces less than 36 inches long, except where shorter single-length pieces are necessary.
 2. Stagger joints in adjacent and related members.
 3. Arrange joints to shed water.
 4. Seal cut ends, both exposed and in butt joints, per manufacturer recommendations.
- D. Caulk panel and trim joints to exclude water. Use paintable caulking specified in Section 07920.
- E. Touch up bare and damaged areas of factory-applied primer.

3.3 CLEANING

- A. Clean and prepare exposed surfaces for painting.
- B. Remove and provide new replacement products for siding, panels, and trim with soiling or staining that cannot be cleaned satisfactorily.

END OF SECTION

SECTION 07 53 23

ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

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. Adhered membrane roofing system.
 - 2. Vapor retarder.
 - 3. Roof insulation.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Division 07 Section "Thermal Insulation" for insulation beneath the roof deck.
 - 3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
 - 4. Division 07 Section "Joint Sealants."
 - 5. Division 22 Section "Storm Drainage Piping Specialties" for roof drainage.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.
- C. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Insulation fastening patterns.
- C. Samples for Verification: For the following products:
 - 1. 12-by-12-inch square of sheet roofing, of color specified, including T-shaped side and end lap seam.
 - 2. 12-by-12-inch square of roof insulation.
 - 3. 12-inch length of metal termination bars.
 - 4. 12-inch length of battens.
 - 5. Six insulation fasteners of each type, length, and finish.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of meeting performance requirements.
- F. Qualification Data: For Installer and manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
- H. Research/Evaluation Reports: For components of membrane roofing system.
- I. Maintenance Data: For roofing system to include in maintenance manuals.
- J. Warranties: Special warranties specified in this Section.
- K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
- B. Manufacturer Qualifications: A qualified manufacturer that has UL listing for membrane roofing system identical to that used for this Project.
- C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain components for membrane roofing system [from same manufacturer as roofing membrane.
- E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
 - 2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
1. Special warranty includes roofing membrane, base flashings, roofing accessories, roof insulation, fasteners, vapor retarder and other components of membrane roofing system.
 2. Warranty Period: 15 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 EPDM ROOFING MEMBRANE

- A. EPDM Roofing Membrane: ASTM D 4637, Type I, nonreinforced uniform, flexible sheet made from EPDM, and as follows:
1. Manufacturers:
 - a. Carlisle SynTec Incorporated.
 - b. Celotex Corporation.
 - c. ERSystems.

- d. Firestone Building Products Company.
 - e. GenFlex Roofing Systems.
 - f. International Diamond Systems.
 - g. Johns Manville International, Inc.
 - h. Mule-Hide Products Co., Inc.
 - i. Protective Coatings, Inc.
 - j. Roofing Products International, Inc.
 - k. Stafast Roofing Products.
 - l. Versico Inc.
 - m. Approved Manufacturer.
- 2. Thickness: 60 mils, nominal.
 - 3. Exposed Face Color: White.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Cold Fluid-Applied Membrane Adhesive: Manufacturer's standard cold fluid-applied bonding adhesive formulated to adhere fleece-backed roofing membrane to substrate.
- E. Seaming Material: Single-component butyl splicing adhesive and splice cleaner.
- F. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.
- G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- H. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- I. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- J. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
- L. Liquid coating, specifically formulated for coating EPDM roofing membrane, as follows:

1. Type: Acrylic emulsion.
2. Color: As selected by Architect from manufacturer's full range of colors.

2.4 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.
 1. Product: Subject to compliance with requirements, provide "Dens-Deck" manufactured by Georgia-Pacific Corporation.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening substrate panel to roof deck.

2.5 VAPOR RETARDER

- A. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils thick, minimum, with maximum permeance rating of 0.13 perm.
 1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 2. Adhesive: Manufacturer's standard lap adhesive, FMG approved for vapor-retarder application.

2.6 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft minimum density, square edged.
 1. Manufacturers:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Tenneco Building Products.
 - e. Approved Manufacturer.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.7 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.
- D. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric mat, water permeable and resistant to ultraviolet degradation, type and weight as recommended by roofing system manufacturer for application.
- E. Metal Securement System: Perimeter securement flashing and strapping fabricated from stainless steel, a minimum of 0.031 inch thick. Provide fasteners as recommended by mortar-faced insulation manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

- D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions.

3.3 SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.4 VAPOR-RETARDER INSTALLATION

- A. Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively.
 - 1. Seal side and end laps with tape.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.5 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - 1. Set each layer of insulation in a cold fluid-applied adhesive.

3.6 ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
- E. Cold Fluid-Applied Adhesive: Apply cold fluid-applied adhesive to substrate at rate required by manufacturer and install fleece-backed roofing membrane.
- F. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- H. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
 - 1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
- I. Repair tears, voids, and lapped seams in roofing that does not meet requirements.
- J. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.10 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: <Insert name of Owner.>
 - 2. Address: <Insert address.>
 - 3. Building Name/Type: <Insert information.>
 - 4. Address: <Insert address.>
 - 5. Area of Work: <Insert information.>

6. Acceptance Date: <Insert date.>
7. Warranty Period: <Insert time.>
8. Expiration Date: <Insert date.>

- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 75 mph;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.

1. Authorized Signature: **<Insert signature.>**
2. Name: **<Insert name.>**
3. Title: **<Insert title.>**

END OF SECTION 07 53 23

07 62 00 SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum flashing that receives site-applied paint finish.
- B. Prefinished (coil-coated) aluminum flashing.
- C. Fabrication requirements for sheet metal items specified in other sections.
- D. Counterflashings at roof-mounted mechanical and electrical equipment and vent stacks.

1.2 RELATED SECTIONS

- A. Section 07411: Gutters, scuppers, and downspouts fabricated from coil-coated metal.
- B. Section 07920: Joint sealers.
- C. Section 09910: Prime and finish painting.

1.3 SYSTEM DESCRIPTION

- A. Install Work of this section to physically protect membrane roofing, base flashings, joints, and other construction from damage that would permit water leakage into the building and to divert water away from protected joints and construction.
- B. Provide system of flashing and counterflashing that will remain in place and be effective during normal weather exposure, including wind design conditions stated in Section 07531.

1.4 SUBMITTALS – ACTION

- A. Comply with requirements of Section 01330.
- B. Product Data: Proprietary products.
- C. Shop Drawings: Show materials, profiles, joint locations, joint details, fastening methods. Draw layouts at minimum 1/4 inch scale, details at 3 inch scale.
- D. Selection Samples: Available colors for prefinished aluminum flashing.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in sheet metal flashing work with minimum 3 years experience.
- B. Reference Standard: Perform Work in compliance with standard details and recommendations of SMACNA Architectural Sheet Metal Manual.
- C. Coordination:
 - 1. Coordinate installation of counterflashing receivers and flashing built into masonry.
 - 2. Coordinate execution with interfacing and adjoining work for proper sequencing that will protect the building, contents, and other work from weather damage during the construction period.

1.6 DELIVERY, STORAGE, HANDLING

- A. Comply with requirements of Section 01600.
- B. Stack preformed and prefinished material to prevent twisting, bending, and abrasion, and to provide drainage and ventilation.
- C. Prevent contact with materials that would cause discoloration, staining, corrosion, or other damage.

PART 2 PRODUCTS

2.1 MATERIALS - SHEET METAL

- A. Aluminum Flashing: ASTM B209, 0.60 inch thick; mill finish.
 - 1. Contractor Option: Aluminum flashing may be supplied with factory-applied white or light-colored baked-on primer compatible with specified finish paint.
- B. Prefinished Aluminum Flashing: ASTM B209, 0.60 inch with AA-C12C42R1x high-performance organic finish coating.
 - 1. Coating System: 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; conforming to AAMA 2604 or 2605.
 - 2. Color: As selected by Architect from manufacturer's full range of standard non-metallic colors.
- C. Galvanized Steel Sheet: ASTM A526, G90 commercial quality, or ASTM A527, G90 lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized for painting.
- D. Stainless-Steel Sheet: ASTM A240/A 240M, Type 304.
 - 1. Finish: 2D [dull, cold rolled].

2.2 ACCESSORIES

- A. Fasteners:
 - 1. Aluminum: Stainless steel or aluminum.
 - 2. Prefinished Aluminum: Stainless steel or aluminum. Where exposed, provide fasteners with heads coated to match sheet metal finish.
 - 3. Stainless Steel: Stainless steel.
 - 4. Galvanized Steel: Stainless steel or hot-dip galvanized steel with soft neoprene washers at exposed locations.
- B. Underlayment: ASTM D226, Type II No. 30, asphalt-saturated organic felt, nonperforated.
- C. Slip Sheet: Rosin sized building paper.

2.3 FABRICATION

- A. Machine form sections true to shape, accurate in size, square, and free from distortion or other defects.
- B. Form pieces in minimum 8 ft lengths.

- C. Fabricate cleats and starter strips of same material as sheet, minimum 1-1/2 inches wide, interlockable with item to be fastened.
- D. Fabricate vertical faces with bottom edges formed outward 1/4 inch and hemmed to form drip.
- E. Return and brake other exposed edges.
- F. Counterflashing: Galvanized steel, 0.0336 inch [nominal 22 gage] thick.
 - 1. Fabricate counterflashing to allow toe to extend minimum 2 inches over protected construction.
 - 2. Fabricate vertical faces with bottom edges formed outward 1/4 inch and hemmed to form drip.
- G. Metal Trim for Synthetic Stone: Stainless steel, 0.015 inch thick. Brake form angle shape with minimum 1-1/2 inch anchorage flange, depth to match mortar thickness. Hem outer edge.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that roof openings, curbs, nailers, and penetrations are in place and rigidly set.
- B. Verify that membrane termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- A. Furnish sufficient quantity of items to be built into masonry and installation instructions at appropriate time that will not delay Project progress.

3.3 INSTALLATION

- A. Comply with requirements of Section 01700.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat contact side of uncoated aluminum and stainless steel where flashing and trim will contact treated wood, ferrous metal, or cementitious construction.
 - 2. Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install underlayment and slip sheet.
- C. Anchor units of work securely in place and provide for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated.
- D. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
 - 1. Arrange joints to shed water.
 - 2. Lap flashing joints minimum 4 inches.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- F. Install exposed sheet metal flashing and trim without buckling, distortion, or tool marks.
- G. Fit flashings tightly in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

- H. Bed flanges of work in sealant shown or where needed for waterproof performance.
- I. Install counterflashings with minimum 4-inch lap over protected construction. Lap counterflashing joints minimum 4 inches.
- J. Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

3.4 CLEANING

- A. Remove substances from exposed metal surfaces that cause staining, corrosion of metal, or deterioration of finishes.

END OF SECTION

**SECTION 07710
MANUFACTURED ROOF SPECIALTIES**

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 the following manufactured roof specialties:
 - 1. Roof edge flashings.
 - 2. Roof edge drainage systems.
 - 3. Counterflashings
- B. Related Sections include the following:
 - 1. Division 5 Section "Architectural Joint Systems" for manufactured sheet metal expansion-joint covers.
 - 2. Division 6 Section Rough Carpentry for wood nailers, curbs, and blocking.
 - 3. Division 7 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
 - 4. Division 7 Section "Joint Sealants" for field-applied sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Manufacture and install manufactured roof specialties to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. FMG Listing: Manufacture and install roof edge flashings that are listed in FMG's "Approval Guide" and approved for Windstorm Classification, Class 1-105. Identify materials with FMG markings.
- C. Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: FMG Loss Prevention Data Sheet 1-49.
- D. Thermal Movements: Provide manufactured roof specialties that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

- E. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.

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.
- B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:
 - 1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.
 - 2. Details for expansion and contraction.
- C. Samples for Initial Selection: For each type of manufactured roof specialty indicated with factory-applied color finishes.
- D. Fabrication Samples: For roof edge flashings, roof edge drainage systems and counterflashings made from 12-inch (300-mm) lengths of full-size components including fasteners, cover joints, accessories, and attachments.
- E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.6 COORDINATION

- A. Coordinate installation of manufactured roof specialties with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

- 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
 - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 5. Basis-of-Design Product: The designs for roof edge flashings, roof edge drainage system and counterflashings are based on the products named. Subject to compliance with requirements, provide either the named products or comparable products by one of the other manufacturers specified.

2.2 EXPOSED METALS

- A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold rolled, mill finished.
- B. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for use and finish indicated, finished as follows:
 - 1. Surface: Smooth, flat finish.
 - 2. Mill finish.
- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
 - 1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 - b. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

- c. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
 - d. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, No. 3 reflective, polished directional satin finish.
- E. Prepainted, Zinc-Coated Steel Sheet: ASTM A 653/A 653M, G90 coating designation, structural quality, and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
- 1. Surface: Smooth, flat finish.
 - 2. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.3 CONCEALED METALS

- A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for use and structural performance indicated, mill finished.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
- C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- G. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.5 ROOF EDGE FLASHINGS

- A. Roof Edge Fascia: Manufactured, two-piece, roof edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding **12 feet (3.6 m)** and a continuous formed- or extruded-aluminum anchor bar with integral drip edge cleat to engage fascia cover. Provide matching mitered and welded corner units.
 - 1. Available Manufacturers:
 - a. Hickman, W. P. Company.
 - b. Metal-Era, Inc.
 - c. MM Systems Corporation.
 - d. Extruded Aluminum: **0.040 inch (1.0 mm)** thick.
 - e. Prepainted, Zinc-Coated Steel: **0.034 inch (0.85 mm)** thick.
 - 2. Fascia Cover Color: As selected by Architect from manufacturer's full range.
 - 3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 4. Fascia Accessories: Fascia extenders with continuous hold-down cleats, soffit trim

2.6 ROOF EDGE DRAINAGE SYSTEMS

- A. Available Manufacturers:
 - 1. Architectural Products Co.
 - 2. ATAS International, Inc.
 - 3. Berger Bros. Co.
 - 4. Castle Metal Products.
 - 5. Cheney Flashing Company.
 - 6. Hickman, W. P. Company.
 - 7. Merchant & Evans, Inc.
 - 8. Metal-Era, Inc.
 - 9. Metal-Fab Manufacturing LLC.
 - 10. MM Systems Corporation.
 - 11. Obdyke, Benjamin Incorporated.
 - 12. Perimeter Systems, a division of Southern Aluminum Finishing Co.
 - 13. Petersen Aluminum Corp.
- B. Gutters and Downspouts: Manufactured formed gutter in uniform section lengths not exceeding **12 feet (3.6 m)**, with mitered and welded or soldered corner units, end caps, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front gutter rim. Furnish with flat-stock gutter straps and gutter support brackets and expansion joints and expansion-joint covers fabricated from same metal as gutters.

1. Fabricate gutter from the following exposed metal:
 - a. Aluminum: **0.040 inch (1.0 mm)** thick.
2. Gutter Style: **(A)** according to SMACNA's "Architectural Sheet Metal Manual."
3. Applied Fascia Cover: Exposed, formed aluminum, **0.040 inch (1.0 mm)** thick with mitered corners, end caps, and concealed splice joints.
4. Gutter Accessories: Wire ball downspout strainer.
5. Downspouts: Rectangular, open-face with mitered elbows, manufactured from the following exposed metal. Furnish wall brackets, from same material and finish as downspouts, with anchors.
 - a. Formed Aluminum: **0.040 inch (1.0 mm)** thick.
 - b. Extruded Aluminum: **0.125 inch (3.2 mm)** thick.

2.7 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
 1. Examine walls, roof edges, and parapets for suitable conditions for manufactured roof specialties.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
 1. Install manufactured roof specialties with provisions for thermal and structural movement.
 2. Torch cutting of manufactured roof specialties is not permitted.

- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing exposed-to-view components of manufactured roof specialties directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.
- D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
- E. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties. Space movement joints at a maximum of 12 feet (3.6 m) with no unplanned joints within 18 inches (450 mm) of corners or intersections.
- F. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- G. Seal joints with elastomeric sealant as required by manufacturer of roofing specialties.

3.3 ROOF EDGE FLASHING INSTALLATION

- A. Install cleats, cant dams, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings to resist uplift and outward forces according to performance requirements.

3.4 ROOF EDGE DRAINAGE SYSTEM INSTALLATION

- A. General: Install gutters, downspouts, conductor heads to produce a complete roof drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Gutters: Join and seal gutter lengths. Attach gutters to firmly anchored gutter brackets spaced not more than 36 inches (900 mm) apart. Slope gutters to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.2 m) apart. Install expansion joint caps.
 - 2. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
 - 1. Provide elbows at base of downspout to direct water away from building.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07710

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof curbs.
 - 2. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.
- C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
- D. Samples: For each type of exposed factory-applied color finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

1.4 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
 - 1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes.

1.8 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

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, manufacturers listed in other Part 2 articles.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

- A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated and mill phosphatized for field painting.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.
- C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, **Class AZ50** coated.
 - 2. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
 - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in AAMA 2604, except as modified below:
 - 1) Humidity Resistance: 2000 hours.
 - 2) Salt-Spray Resistance: 2000 hours.
- D. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and finish. Coil-coat finish as follows:
 - 1. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
- E. Aluminum Extrusions and Tubes: ASTM B 221, alloy and temper recommended by manufacturer for type of use, mill finished.
- F. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.
- G. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.
- H. Steel Tube: ASTM A 500, round tube, baked-enamel finished.
- I. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.
- J. Galvanized Steel Pipe: ASTM A 53/A 53M.

2.3 MISCELLANEOUS MATERIALS

- A. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, 1 inch thick.
- B. Glass-Fiber Board Insulation: ASTM C 726, 1 inch thick.
- C. Polyisocyanurate Board Insulation: ASTM C 1289, 1 inch thick.
- D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWWA C2; not less than 1-1/2 inches thick.
- E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- F. Polyethylene Sheet: 12-mil- thick, polyethylene sheet complying with ASTM D 4397.
- G. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft..
- H. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
- I. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- J. Elastomeric Sealant: ASTM C 920, silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- K. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.
- L. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.4 ROOF CURBS

- A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
 - 1. Manufacturers:
 - a. Colony Custom Curbs.
 - b. Commodity Products Company, Inc.

- c. Conn-Fab Sales, Inc.
 - d. Curbs Plus Inc.
 - e. Custom Curb, Inc.
 - f. LM Curbs.
 - g. Loren Cook Company.
 - h. Metallic Products Corporation.
 - i. Pate Company (The).
 - j. Roof Products & Systems Corporation.
 - k. Roof Products, Inc.
 - l. Thaler Metal Industries Ltd.
 - m. ThyCurb; Div. of Thybar Corporation.
 - n. Uni-Curb, Inc.
 - o. Vent Products Company, Inc.
 - p. Approved Manufacturer.
- 2. Load Requirements: Verify with Mechanical Contractor.
 - 3. Material: Aluminum sheet, 0.090 inch thick.
 - 4. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 5. Factory install wood nailers at tops of curbs.
 - 6. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 - 7. Factory insulate curbs with 1-1/2-inch- thick, glass-fiber board insulation.
 - 8. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
 - 9. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.5 EQUIPMENT SUPPORTS

- A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

- 1. Manufacturers:
 - a. Colony Custom Curbs.
 - b. Commodity Products Company, Inc.
 - c. Conn-Fab Sales, Inc.
 - d. Curbs Plus Inc.
 - e. Custom Curb, Inc.
 - f. LM Curbs.
 - g. Loren Cook Company.
 - h. Metallic Products Corporation.
 - i. Pate Company (The).
 - j. Roof Products & Systems Corporation.
 - k. Roof Products, Inc.

- l. Thaler Metal Industries Ltd.
 - m. ThyCurb; Div. of Thybar Corporation.
 - n. Uni-Curb, Inc.
 - o. Vent Products Company, Inc.
 - p. Approved Manufacturer.
2. Load Requirements: Verify with Mechanical Contractor.
 3. Material: Aluminum sheet, 0.090 inch thick.
 4. Factory-install continuous wood nailers 3-1/2 inches wide at tops of equipment supports.
 5. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
 6. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 7. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
 8. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 2. Verify dimensions of roof openings for roof accessories.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Install roof accessories to fit substrates and to result in watertight performance.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
 3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
- E. Roof Curb Installation:
1. Set roof curb so top surface of roof curb is level.
- F. Equipment Support Installation:
1. Set equipment support so top surface of equipment support is level.
- G. Roof Hatch Installation:
1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
 2. Attach safety railing system to roof hatch curb.
 3. Attach ladder safety post according to manufacturer's written instructions.
- H. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.
- 3.3 TOUCH UP
- A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 painting Sections.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- 3.4 CLEANING
- A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 07 72 00

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SECTION 07 84 13 - PENETRATION FIRESTOPPING

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 through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Related Sections include the following:
 - 1. Division 07 Section "Fire-Resistive Joint Systems."
 - 2. Division 21 Sections specifying fire-suppression piping penetrations.
 - 3. Division 22 and 23 Sections specifying duct and piping penetrations.
 - 4. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
 - 3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/sq. ft at both ambient temperatures and 400 deg F .

- C. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 - 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
- D. Qualification Data: For Installer.
- E. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.
- F. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting
 - 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) OPL in its "Directory of Listed Building Products, Materials, & Assemblies."
 - 3) ITS in its "Directory of Listed Products."
 - 4) FM Global
- E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers:
 - 1. A/D Fire Protection Systems Inc.
 - 2. Grace, W. R. & Co. - Conn.
 - 3. Hilti, Inc.
 - 4. Johns Manville.
 - 5. Nelson Firestop Products.
 - 6. NUCO Inc.
 - 7. RectorSeal Corporation (The).
 - 8. Specified Technologies Inc.
 - 9. 3M; Fire Protection Products Division.
 - 10. Tremco; Sealant/Weatherproofing Division.
 - 11. USG Corporation.

2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
 1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Through-penetration firestop system manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove

damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

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**SECTION 07920
JOINT SEALANTS**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Elastomeric sealants for exposed joints.
- B. Sanitary sealant.
- C. Paintable caulking.
- D. Compressible sill gaskets.

1.2 RELATED SECTIONS

- A. Sealants for fabrication and concealed sealants applied during installation of other work are not specified in this Section.
- B. Section 07841: Firestopping sealants.
- C. Section 08800: Glazing sealants.
- D. Section 09820: Acoustical sealants.

1.3 DEFINITIONS

- A. The word "caulking" may be used in drawing notes or consultant specifications to refer to elastomeric sealants. Notwithstanding such uses, provide joint seal products for various locations as indicated by the schedule at the end of this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. Exterior joint sealers shall provide continuous, weatherproof seals to prevent infiltration of air and water through the joints in which they are installed.
- B. Interior joint sealers shall provide continuous seals to prevent air and smoke infiltration through the joints in which they are installed, except that sanitary sealant shall also prevent water infiltration.
- C. Joint sealers shall be fully compatible with all surfaces (including other sealers) they contact. Compatibility includes:
 - 1. No adverse affect on cohesion and other physical properties.
 - 2. No adverse affect on weathering abilities.
 - 3. No staining or change of color.
 - 4. Secure, permanent adhesion between sealer and other material.
- D. Appearance: Cured sealants shall have smooth surfaces free of gaps, voids, bubbles, lumps, crevices, runs, drips, striations, and other irregularities.

1.5 SUBMITTALS – ACTION

- A. Comply with requirements of Section 01330.
- B. Product Data: Each required type of sealant.

1. All sealants shall be submitted for review in a single group pursuant to Section 01330, Paragraph 1.3.E. Multiple submittals for sealants are not acceptable.
- C. Samples: Cured samples of elastomeric sealants in available standard sealant color selections.
- D. Verification Samples: Cured samples of custom colors.

1.6 QUALITY ASSURANCE

- A. Sole Source Requirements: Provide only one brand of sealant for each required type, regardless of the number of applicators.
- B. Sample Applications: Apply appropriate joint sealers to joints in mock-up panels and other sample installations of exterior and interior finished Work to demonstrate workmanship and appearance, and to be comparison standard for judging completed Work.

1.7 DELIVERY, STORAGE, HANDLING

- A. Comply with requirements of Section 01600.
- B. Prevent contamination and loss of performance or application characteristics.

1.8 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with execution under unfavorable weather conditions.
 1. Minimum Ambient and Substrate Temperature: 40 deg F for elastomeric sealants, 60 deg F for acrylic materials.
 2. Maximum Ambient and Substrate Temperature: Do not exceed manufacturer's recommended limit or 90 deg F, whichever is lower.
- B. Do not apply sealants to joint surfaces that are wet, damp, or frozen.

1.9 SEQUENCING

- A. Apply interior caulking before finish paint coats.
- B. Where sanitary sealant is in contact with painted surfaces, apply sealant after finish painting.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide one proprietary product for each type of sealant required.
- B. Select sealants for compatibility requirements.
- C. Multiple colors may be required for exposed sealants to coordinate with substrate colors.
- D. Exterior Sealant: ASTM C920, Type S, Grade NS, Class 25, medium-modulus silicone-based sealant. Supply product in standard colors selected by Architect.
 1. 795 Silicone Sealant; Dow Corning
 2. 865 Silicone Sealant; Pecora Corp.
 3. Silpruf; General Electric Co.
 4. Spectrum 2; Tremco, Inc.

- E. Interior Color Sealant: ASTM C920, Type M, Grade NS, Class 25, multi-part urethane-based sealant. Provide product in multiple custom colors selected by Architect.
 - 1. Chem-Calk 500; Bostik Constr. Products Div.
 - 2. Vulkem 227; Mameco International, Inc.
 - 3. Dynatrol II; Pecora Corp.
 - 4. Dymeric; Tremco, Inc.
- F. Sanitary Sealant: Sanitary-type mold-resistant silicone rubber based elastomeric sealant in standard colors selected by Architect.
- G. Paintable Caulking: ASTM C834; mildew-resistant acrylic emulsion, non-staining and non-bleeding type suitable for painting.
- H. Compressible Sill Gaskets: 1/4-inch thick, flexible, closed cell foam plastic.
 - 1. AMOCO; Amofoam Sill Sealer
 - 2. Dow; Styrofoam Sill Seal

2.2 ACCESSORIES

- A. Joint Fillers: Closed-cell joint fillers acceptable to sealant manufacturer, except furnish open-cell filler where recommended by sealant manufacturer for joint type, and compatible with materials fillers contact. Supply fillers in indicated shapes and sized for 25-35 percent compression when installed.
- B. Cleaners, Joint Primers, Surface Sealers: As recommended by sealant manufacturer for Project applications and compatible with joint materials and surface finishes.
- C. Bond Breaker Tape: Plastic tape recommended by sealant manufacturer for application to sealant-contact surfaces to prevent bond to substrate or joint filler. Furnish self-adhesive tape where needed.
- D. Masking: Nonstaining materials that will not leave residue or adversely affect substrates.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrates are sufficiently dry for installation.
- B. Verify that concrete and masonry substrates have cured minimum 28 days.

3.2 PREPARATION

- A. Comply with sealant manufacturer's recommendations for joint preparation.
- B. Clean joint surfaces immediately before installation of sealants. Use methods that will neither damage surfaces nor leave residues that impair sealer adhesion.
 - 1. Remove dirt, insecure coatings, moisture and other substances which could impair adhesion.
- C. Priming: Prime or seal joint surfaces where recommended by sealant manufacturer. Confine primers and sealers to areas of sealant bond; do not allow spillage or migration onto adjoining surfaces.

- D. Masking: Mask surfaces adjacent to joints to receive elastomeric sealants. Use masking materials that will not mar surfaces to which they are applied. Remove masking immediately after tooling and without disturbing joint seal.

3.3 INSTALLATION

- A. Comply with requirements of Section 01700.
- B. Set joint filler units at uniform depths in joints to support sealants and maintain proper sealant cross-section shape and depth within the following general limitations, measured at center (thin) section of beads.
 - 1. Flooring Joints: Sealant depth equal to 75 percent of joint width, but not more than 5/8 inch deep nor less than 3/8 inch deep.
 - 2. Other Joints: Sealant depth equal to 50 percent of joint width, but not more than 1/2 inch deep nor less than 1/4 inch deep.
- C. Install joint fillers under compression and friction fit. Do not install filler units that have absorbed water.
 - 1. Do not leave voids or gaps between ends of joint filler units.
 - 2. Do not stretch, twist, puncture, or tear joint fillers.
- D. Install bond breaker tape where indicated or where joint filler is not used to prevent adhesion to back side of joint or to prevent contact with incompatible substances.
- E. Deposit sealants in uniform, continuous ribbons without gaps or air pockets, with complete wetting of joint bond surfaces equally on opposite sides, and with proper cross-section shape and depth.
- F. Tool sealants to ensure full adhesion. Unless otherwise indicated, form smooth, slightly concave surface.
- G. Do not allow sealants to overflow from confines of joints, to spill onto adjoining work, or to migrate into voids of exposed finishes.
- H. Compressible Sill Gaskets: Install where indicated on Drawings.

3.4 CLEANING

- A. Clean spills, misapplications, and material migrations immediately as they occur.

3.5 PROTECTION

- A. Protect installed joint sealers against contact with contaminating substances and other damage.

3.6 JOINT SEALER APPLICATION SCHEDULE

- A. Exterior Sealant:
 - 1. All exterior joints between similar and dissimilar materials not specifically listed or specified elsewhere.
- B. Interior Color Sealant:
 - 1. Interior joints indicated as 'sealant.'
 - 2. Control and expansion joints in tile and stone flooring.
 - 3. Joints between tile or stone flooring and dissimilar vertical surfaces.

4. Perimeters of door frames, frames and trim for glazing, and frames or trim for other wall and ceiling openings at surfaces with wallcoverings.
- C. Sanitary Sealant:
1. Joints around plumbing fixtures and fittings.
 2. Perimeters of lavatory counters.
- D. Paintable Caulking:
1. Indicated interior joints.
 2. Interior joints, crevices, and irregularities wider than hairline joints in or between dissimilar materials and painted surfaces that are not indicated to receive sealant.
 3. Perimeters of door frames, frames and trim for glazing, and frames or trim for other wall and ceiling openings at painted surfaces.

END OF SECTION

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**SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hollow metal doors and transom panels hung in hollow metal frames at interior and exterior locations.
2. Hollow metal door frames for wood doors and borrowed lights at interior locations.

1.2 RELATED REQUIREMENTS

- A. Frames fabricated of structural steel: Section 05 50 00, METAL FABRICATIONS.
- B. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- C. Glazing: Section 08 80 00, GLAZING.
- D. Card Readers and Biometric Devices: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standard Institute (ANSI):
 1. A250.8-2014 - Standard Steel Doors and Frames.
- C. ASTM International (ASTM):
 1. A240/A240M-15b - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 2. A653/A653M-15 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip.
 3. A1008/A1008M-15 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 4. B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.
 5. B209M-14 - Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 6. B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 7. B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- D. National Association of Architectural Metal Manufacturers (NAAMM):
 1. AMP 500-06 - Metal Finishes Manual.
- E. National Fire Protection Association (NFPA):

1. 80-16 - Fire Doors and Other Opening Protectives.

F. UL LLC (UL):

1. 10C-09 - Positive Pressure Fire Tests of Door Assemblies.
2. 1784-15 - Air Leakage Tests of Door Assemblies and Other Opening Protectives.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 1. Show size, configuration, and fabrication and installation details.
- C. Manufacturer's Literature and Data:
 1. Description of each product.
 2. Include schedule showing each door and frame requirements fire label and smoke control label for openings.
 3. Installation instructions.
- D. Test reports: Certify each product complies products comply with specifications.
 1. Sound rated door.
- E. Qualifications: Substantiate qualifications comply with specifications.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 1. Regularly manufactures specified products.
 2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.

1.6 DELIVERY

- A. Fasten temporary steel spreaders across the bottom of each door frame before shipment.
- B. Deliver products in manufacturer's original sealed packaging.
- C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Design hollow metal doors and frames complying with specified performance:
 - 1. Fire Doors and Frames: UL 10C; NFPA 80 labeled.
 - a. Fire Ratings: See drawings.
 - 2. Smoke Control Doors and Frames: UL 1784; NFPA 80 labeled, maximum 0.15424 cu. m/s/sq. m (3.0 cfm/sf) at 24.9 Pa (0.10 inches water gage) pressure differential.
 - 3. Sound Rated Doors and Frames: Minimum 45 sound transmission class (STC) when tested according to ASTM E90.
 - 4. Thermal Transmittance: .40 U-value, maximum at exterior doors.
 - 5. Thermal Resistance: 2.5 R-value, minimum at exterior doors.

2.2 MATERIALS

- A. Stainless Steel: ASTM A240/A240M; // Type 304 // Type 316 //.
- B. Sheet Steel: ASTM A1008/A1008M, cold-rolled.
- C. Galvanized Sheet Steel: ASTM A653.
- D. Aluminum Sheet: ASTM B209M (ASTM B209).
- E. Aluminum Extrusions: ASTM B221M (ASTM B221).

2.3 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide hollow metal doors and frames from one manufacturer.

2.4 HOLLOW METAL DOORS

- A. Hollow Metal Doors: ANSI A250.8; 44 mm (1-3/4 inches) thick. See drawings for sizes and designs.
 - 1. Interior Doors: Level 1 and Physical Performance Level C, standard duty; Model 2, seamless // at // _____ // locations //.
 - 2. Interior Doors: Level 2 and Physical Performance Level B, heavy duty; Model 2, seamless // at // _____ // locations //.
- B. Door Faces:
 - 1. Interior Doors: Sheet steel // Galvanized sheet steel minimum // Z120 or ZF120 (G40 or A40) // Z180 or ZF180 (G60 or A60) // Z275 (G90) // coating.

2. Exterior Doors: Galvanized sheet steel minimum // Z120 or ZF120 (G40 or A40) // Z180 or ZF180 (G60 or A60) // Z275 (G90) // coating //.

C. Door Cores:

1. Interior Doors: Kraft paper honeycomb.
2. Exterior Doors: Polystyrene.
3. Fire Doors: Manufacturer's standard complying with specified fire rating performance.

2.5 HOLLOW METAL FRAMES

- A. Hollow Metal Frames: ANSI A250.8; face welded See drawings for sizes and designs.

1. Interior Frames:

- a. Level 1 Hollow Metal Doors: 1.0 mm (0.042 inch) thick.
- b. Level 2 Hollow Metal Doors: 1.3 mm (0.053 inch) thick.
- c. Wood Doors and Borrowed Lights : 1.0 mm (0.042 inch).

2. Interior Borrowed Light Frames: 1.3 mm (0.051 inch) thick.

B. Frame Materials:

1. Interior Frames: Sheet steel, Galvanized sheet steel minimum Z120 or ZF120 (G40 or A40).
2. Exterior Frames: Galvanized sheet steel minimum // Z120 or ZF120 (G40 or A40) // Z180 or ZF180 (G60 or A60) // Z275 (G90) // coating.

2.6 FABRICATION

- A. Hardware Preparation: ANSI A250.8; for hardware specified in Section 08 71 00, DOOR HARDWARE.

B. Hollow Metal Door Fabrication:

1. Close top edge of exterior doors flush and seal to prevent water intrusion.
2. Fill spaces between vertical steel stiffeners with insulation.

C. Fire and Smoke Control Doors:

1. Close top and vertical edges flush.
2. Apply steel astragal to active leaf at pair and double egress doors.
 - a. Exception: Where vertical rod exit devices are specified for both leaves swinging in same direction.
3. Fire and Smoke Control Door Clearances: NFPA 80.

D. Sound Rated Doors:

1. Seals: Integral spring type automatic door bottom seal.

E. Hollow Metal Frame Fabrication:

1. Fasten mortar guards to back of hardware reinforcements, except on lead-lined frames.
2. Terminated Stops: ANSI A250.8.
3. Borrowed Light and Panel Opening Frames:
 - a. Provide integral stop on exterior, corridor, or secure side of door.
 - b. Design rabbet width and depth to receive glazing material or panel shown on drawings.
4. Frame Anchors:
 - a. Floor anchors:
 - 1) Provide extension type floor anchors to compensate for depth of floor fills.
 - 2) Provide 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive floor fasteners.
 - 3) Provide 50 mm by 50 mm by 9 mm (2 inch by 2 inch by 3/8 inch) clip angle for lead lined frames, drilled for floor fasteners.
 - 4) Provide mullion 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two floor fasteners and frame anchor screws.
 - 5) Provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for floor fasteners and frame anchor screws for sill sections.
 - a) Space floor bolts 50 mm (2 inches) on center.
 - b. Jamb anchors:
 - 1) Place anchors on jambs:
 - a) Near top and bottom of each frame.
 - b) At intermediate points at maximum 600 mm (24 inches) spacing.
 - 2) Form jamb anchors from steel minimum 1 mm (0.042 inch) thick.
 - 3) Anchors for stud partitions: Provide tabs for securing anchor to sides of studs. Provide one of the following:
 - a) Welded type.
 - b) Lock-in snap-in type.
 - 4) Anchors for frames set in prepared openings:
 - a) Steel pipe spacers 6 mm (1/4 inch) inside diameter, welded to plate reinforcing at jamb stops, or hat shaped

formed strap spacers 50 mm (2 inches) wide, welded to jamb near stop.

- b) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass through frame and spacers.

- 5) Anchors for observation windows and other continuous frames set in stud partitions.

- a) Weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.

- b) Space maximum 600 mm (24 inches) on centers.

- 6) Modify frame anchors to fit special frame and wall construction.

- 7) Provide special anchors where shown on drawings and where required to suit application.

F. Sound Rated Door Frames:

- 1. Seals: Integral continuous gaskets on frames.

2.7 FINISHES

- A. Steel and Galvanized Steel: ANSI A250.8; shop primed.

- B. Finish exposed surfaces after fabrication.

2.8 ACCESSORIES

- A. Primers: ANSI A250.8.

- B. Barrier Coating: ASTM D1187/D1187M.

- C. Welding Materials: AWS D1.1/D1.1M, type to suit application.

- D. Clips Connecting Members and Sleeves: Match door faces.

- E. Fasteners: Galvanized steel.

- 1. Metal Framing: Steel drill screws.

- F. Anchors: Galvanized steel.

- G. Galvanizing Repair Paint: MPI No. 18.

- H. Insulation: Unfaced mineral wool.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.

- B. Protect existing construction and completed work from damage.

- C. Apply barrier coating to metal surfaces in contact with cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions // and approved submittal drawings //.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
 - 2. Install fire doors and frames according to NFPA 80.
 - 3. Install smoke control doors and frames according to NFPA 105.

3.3 FRAME INSTALLATION

- A. Plumb, align, and brace frames until permanent anchors are set.
 - 1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
 - 2. Use wood spreaders at bottom of frame when shipping spreader is removed.
 - 3. Where construction permits concealment, leave shipping spreaders in place after installation, otherwise remove spreaders when frames are set and anchored.
 - 4. Remove wood spreaders and braces when walls are built and jamb anchors are secured.
- B. Floor Anchors:
 - 1. Anchor frame jambs to floor with two expansion bolts.
 - a. Lead Lined Frames: Use 9 mm (3/8 inch) diameter bolts.
 - b. Other Frames: Use 6 mm (1/4 inch) diameter bolts.
 - 2. Power actuated drive pins are acceptable to secure frame anchors to concrete floors.
- C. Jamb Anchors:
 - 1. Metal Framed Walls: Secure anchors to sides of studs with two fasteners through anchor tabs.
- D. Frames for Sound Rated Doors: Fill frames with insulation.
- E. Touch up damaged factory finishes.
 - 1. Repair galvanized surfaces with galvanized repair paint.
 - 2. Repair painted surfaces with touch up primer.

3.4 DOOR INSTALLATION

- A. Install doors plumb and level.
- B. Adjust doors for smooth operation.
- C. Touch up damaged factory finishes.
 - 1. Repair galvanized surfaces with galvanized repair paint.

2. Repair painted surfaces with touch up primer.

3.5 CLEANING

A. Clean exposed door and frame surfaces. Remove contaminants and stains.

3.6 PROTECTION

A. Protect doors and frames from traffic and construction operations.

B. Remove protective materials immediately before acceptance.

C. Repair damage.

- - - E N D - - -

**SECTION 08 14 00
INTERIOR WOOD DOORS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior flush wood doors, transparent, painted finish.
 - a. Fire rated doors.
 - b. Smoke rated doors.

1.2 RELATED REQUIREMENTS

- A. Door Hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.
- B. Installation of Doors and Hardware : Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 71 00, DOOR HARDWARE.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute/Window and Door Manufacturers Association (ANSI/WDMA):
 - 1. I.S. 1A-13 - Architectural Wood Flush Doors.
- C. ASTM International (ASTM):
 - 1. E90-09 - Laboratory Measurements of Airborne Sound Transmission Loss of Building Partitions and Elements.
- D. National Fire Protection Association (NFPA):
 - 1. 80-16 - Fire Doors and Other Opening Protectives.
 - 2. 252-12 - Fire Tests of Door Assemblies.
- E. UL LLC (UL):
 - 1. 10C-09 - Positive Pressure Fire Tests of Door Assemblies.
- F. Window and Door Manufacturers Association (WDMA):
 - 1. TM 7-14 - Cycle-Slam Test.
 - 2. TM 8-14 - Hinge Loading Test.
 - 3. TM 10-14 - Screw Holding Capacity.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
 - 2. Include details of glazing.

3. Indicate project specific requirements not included in Manufacturer's Literature and Data submittal.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Fire rated doors showing conformance with NFPA 80.

D. Samples:

1. Corner section of flush veneered door 300 mm (12 inches) square, showing details of construction, labeled to show grade and type number and conformance to specified standard.
2. Veneer sample 200 mm by 275 mm (8 inch by 11 inch) showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample where the prefinished option is accepted.

E. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Regularly and presently manufactures specified products.
2. Manufactures specified products with satisfactory service on five similar installations for minimum five years.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

1. Minimum 0.15 mm (6 mil) polyethylene bags or cardboard packaging to remain unbroken during delivery and storage.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, and manufacture date.

1. Identify door opening corresponding to Door Schedule.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight, conditioned facility.

1. Store doors according to ANSI/WDMA I.S. 1A.

B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Temperature Range: 21 to 27 degrees C (70 to 80 degrees F) continuously, beginning 48 hours before installation.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.
 - a. Comply with door manufacturer's instructions for relative humidity.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant interior factory finished // flush // stile and rail // wood doors against material and manufacturing defects.
 1. Warranty Period: Lifetime of original installation.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

- A. Basis of Design: Room Finish Schedule.
- B. Provide each product from one manufacturer.

2.2 FLUSH WOOD DOORS

- A. General:
 1. ANSI/WDMA I.S. 1A, Extra Heavy Duty.
 2. Adhesive: Type II.
 3. Core: Structural composite lumber, except when mineral core is required for fire rating.
 4. Thickness: 44 mm (1-3/4 inches) unless otherwise shown or specified.
- B. Faces:
 1. ANSI/WDMA I.S. 1A.
 2. One species throughout project unless scheduled or otherwise shown.
 3. Transparent Finished Faces: Premium Grade. rotary cut, to match existing.
 - a. Face veneer.
 - b. Match face veneers for doors for uniform effect of color and grain at joints.
 - c. Door Edges: Same species as door face veneer, except maple is acceptable for stile face veneer on birch doors.

- d. In Elder Services Garage addition, where doors are required to have transparent finish, use wood species, grade, and assembly of face veneers to match adjacent existing doors of Anna John Nursing Home. New wood doors at Elder Lodge Garages to match finish of doors in Lodge Corridors.
- 4. Painted Finishes: Custom Grade, mill option close grained hardwood, premium or medium density overlay.
- 5. Factory sand doors for finishing.
- C. Wood For Stops, Louvers, Muntins and Moldings For Flush Doors Required to Have Transparent Finish:
 - 1. Solid wood of same species as face veneer, except maple is acceptable on birch doors.
 - 2. Glazing:
 - a. On non-fire-rated doors, use applied wood stops nailed tightly on room side and attached on opposite side with flathead, countersunk wood screws, spaced approximately 125 mm (5 inches) on center.
 - 3. Wood Louvers:
 - a. Door manufacturer's standard product, fabricated of solid wood sections.
 - b. Wood Slats: minimum 5 mm (3/16 inch) thick.
 - c. Stiles routed out to receive slats.
 - d. Secure louvers in prepared cutouts with wood stops.
- D. Fire-Rated Wood Doors:
 - 1. Fire Resistance Rating:
 - a. B Label: 1-1/2 hours.
 - b. C Label: 3/4 hour.
 - 2. Labels:
 - a. Comply with NFPA 252, UL 10C, and labeled by qualified testing and inspection agency showing fire resistance rating.
 - b. Metal labels with raised or incised markings.
 - 3. Performance Criteria for Stiles of Doors Utilizing Standard Mortise Leaf Hinges:
 - a. Hinge Loading: WDMA TM 8. Average of 10 test samples for Extra Heavy Duty doors.
 - b. Direct Screw Withdrawal: WDMA TM 10 for Extra Heavy Duty doors. Average of 10 test samples using a steel, fully threaded #12 wood screw.

- c. Cycle-Slam: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested according to WDMA TM 7.
- 4. Hardware Reinforcement:
 - a. Provide fire, smoke rated doors with hardware reinforcement blocking.
 - b. Size of lock blocks as required to secure hardware specified.
 - c. Top, Bottom and Intermediate Rail Blocks: Minimum 125 mm (5 inches) by full core width.
 - d. Reinforcement blocking in compliance with labeling requirements.
 - e. Mineral material similar to core is not acceptable.
- 5. Other Core Components: Manufacturer's standard as allowed by labeling requirements.
- 6. Glazed Vision Panel Frame: Steel approved for use in labeled doors.
- 7. Astragal: Steel type for pairs of doors.
- E. Smoke Barrier Doors:
 - 1. Glazed Vision Panel Frame: Steel approved for use in labeled doors.
 - 2. Astragal: Steel type for pairs of doors, including double egress doors.

2.3 FABRICATION

- A. Factory machine interior wood doors to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.
 - 1. Factory fit fire rated doors according to NFPA 80.
- B. Rout doors for hardware using templates and location heights specified in Section 08 71 00, DOOR HARDWARE.
- C. Factory fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (2 inches) of door thickness // undercut where shown //.
- D. Clearances between Doors and Frames and Floors:
 - 1. Fire Rated Doors: Comply with NFPA 80.
 - a. Doors with Automatic Bottom Seal: Maximum clearance 10 mm (3/8 inch) at threshold.
 - b. Other Door Bottoms: Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 19 mm (3/4 inch) clearance at bottom, except as otherwise specified.
 - 2. Door Jambs, Heads, and Meeting Stiles: Maximum 3 mm (1/8 inch).
- E. Provide cutouts for glazed and louver openings.
- F. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.

- G. Identify each door on top edge.
 - 1. Mark with stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, date of manufacture and quality.
 - 2. Mark door or provide separate certification including name of inspection organization.
 - 3. Identify door manufacturing standard, including glue type.
 - 4. Identify veneer and quality certification.
 - 5. Identification of preservative treatment for stile and rail doors.

2.4 FINISHES

- A. Field Finished Doors: Seal top and bottom edges of doors with two coats of catalyzed polyurethane or water resistant sealer.
- B. Factory Transparent Finish:
 - 1. Factory finish flush wood doors.
 - a. ANSI/WDMA I.S. 1A Section F-3 Finish System Descriptions for System 5, Conversion Varnish or System 7, Catalyzed Vinyl.
 - b. Use stain when required to produce finish specified in Section Room Finish Schedule.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
 - 1. Verify door frames are properly anchored.
 - 2. Verify door frames are plumb, square, in plane, and within tolerances for door installation.
- B. Protect existing construction and completed work from damage.
- C. Install astragal on active leaf of pair of smoke doors and one leaf of double egress smoke doors.

3.2 INSTALLATION

- A. Install products according to manufacturer's instructions // and approved submittal drawings //.
 - 1. Install fire rated doors according to NFPA 80.
 - 2. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 PROTECTION

- A. After installation, place shipping container over door and tape in place.
 - 1. Do not apply tape to door faces and edges.
- B. Provide protective covering over exposed hardware in addition to covering door.
- C. Maintain covering in good condition until removal is directed by Contracting Officer's Representative.

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SECTION 08 14 16 - FLUSH WOOD DOORS

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. Solid-core doors with wood-veneer faces.

- B. Related Sections:

- 1. Division 06 Section "Interior Architectural Woodwork" for wood door frames.
 - 2. Division 08 Section "Glazing" for glass view panels in flush wood doors.
 - 3. Division 09 Sections "Staining and Transparent Finishing" for field finishing doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings.

- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

- 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire-protection ratings for fire-rated doors.

- C. Samples for Verification:

- 1. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide samples for each species of veneer and solid lumber required.
 - 2. Frames for light openings, 6 inches long, for each material, type, and finish required.

- D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.
- C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
 - 2. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
 - 3. Provide WI-Certified Compliance Certificate for installation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

3. Warranty Period for Solid-Core Interior Doors: Life of installation.

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. Algoma Hardwoods, Inc.
 2. Ampco, Inc.
 3. Buell Door Company Inc.
 4. Chappell Door Co.
 5. Eagle Plywood & Door Manufacturing, Inc.
 6. Eggers Industries.
 7. Graham; an Assa Abloy Group company.
 8. Haley Brothers, Inc.
 9. Ideal Architectural Doors & Plywood.
 10. Ipik Door Company.
 11. Lambton Doors.
 12. Marlite.
 13. Marshfield Door Systems, Inc.
 14. Mohawk Flush Doors, Inc.; a Masonite company.
 15. Oshkosh Architectural Door Company.
 16. Poncraft Door Company.
 17. Vancouver Door Company.
 18. VT Industries Inc.
 19. Approved Manufacturer.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade: Heavy Duty.
- C. Structural-Composite-Lumber-Core Doors:
 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 1. Grade: Premium, with Grade A faces.

2. Species: Match existing, adjacent Anna John Nursing Home.
3. Cut: Match existing, adjacent Anna John Nursing Home.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: [Center-balance match.
6. Exposed Vertical Edges: Same species as faces.
7. Core: Structural composite lumber.
8. Construction: Seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
9. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.4 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
1. Wood Species: Same species as door faces] .
 2. Profile: [Flush rectangular beads.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.6 SHOP PRIMING

- A. Doors for Transparent Finish: Shop prime doors with stain (if required), other required pretreatments, and first coat of finish as specified in Division 09 Section "Staining and Transparent Finishing." Seal all four edges, edges of cutouts, and mortises with first coat of finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

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**SECTION 08 31 13
ACCESS DOORS AND FRAMES**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and panels installed in walls and ceilings.

1.2 RELATED REQUIREMENTS

A. FABRICATIONS.

B. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.

C. Field Painting: Section 09 91 00, PAINTING.

D. Access Doors for Plumbing Valves: Section 21 40 00, PLUMBING FIXTURES.

E. Locations of Access Doors for Ductwork Cleanouts: Section 23 31 00,
HVAC DUCTS AND CASINGS.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Welding Society (AWS):

1. D1.3/D1.3M-08 - Structural Welding Code - Sheet Steel.

C. ASTM International (ASTM):

1. A653/A653M-15 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Sip Process.
2. A1008/A1008M-15 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.
3. A666-15 - Annealed or Cold-Worked Austenitic Stainless Steel sheet, Strip, Plate, and Flat Bar.
4. E119-15 - Fire Test of Building Construction and Materials.

D. National Fire Protection Association (NFPA):

1. 80-16 - Fire Doors and Other Opening Protectives.
2. 251-12 - Fire Tests of Door Assemblies.

E. National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 500-06 - Metal Finishes Manual.

F. UL LLC (UL):

1. Listed - Online Certifications Directory.
2. 10B-08 - Standard for Fire Tests of Door Assemblies.
3. 263-11 - Fire Tests of Building Construction and Materials.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Installation instructions.

1.5 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage during handling and construction operations.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify field conditions affecting access door fabrication and installation. Show field measurements on Submittal Drawings.
 - 1. Coordinate field measurement and fabrication schedule to avoid delay.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Sheet: ASTM A1008/A1008M.
- B. Galvanized Steel: ASTM A 653/A 653M.
- C. Stainless Steel: ASTM A666; Type 302 or Type 304.

2.2 PRODUCTS - GENERAL

- A. Provide each product from one manufacturer.

2.3 ACCESS DOORS, FIRE-RATED

- A. Door Construction:
 - 1. Ceiling Access Door Construction: ASTM E119 or UL 263.
 - 2. Wall Access Doors: NFPA 252 or UL 10B.
- B. Label: Class B opening according to UL 10B or test by another nationally recognized laboratory. 1 hour fire-rated, 1-1/2 hour fire-rated, with maximum temperature rise of 120 degrees C (216 degrees F).
- C. Door Panel: Minimum 0.9 mm (0.0359 inch) thick steel with mineral-fiber insulation core, insulated sandwich type construction.
- D. Frame: Minimum 1.5 mm (0.0598 inch) thick steel sheet, depth and configuration to suit material and construction type where installed.
 - 1. Frame Flange: Provide at units installed in concrete, masonry, or gypsum board.
 - 2. Exposed Joints in Flange: Weld and grind smooth.
- E. Provide automatic closing device.
- F. Hinge: Continuous steel hinge with stainless steel pin.
- G. Lock: Self-latching, mortise type with provision for fitting flush a standard screw-in type lock cylinder.
 - 1. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
 - 2. Latch release device operable from inside of door.
- H. Anchors for Fire-Rated Access Doors: Comply with requirements of applicable fire test.

2.4 ACCESS DOORS, FLUSH PANEL, NON-RATED

- A. Door Panel:
 - 1. 1.5 mm (0.06 inch) thick steel sheet.
 - 2. Reinforce to maintain flat surface.
- B. Frame:
 - 1. 1.5 mm (0.06 inch) thick steel sheet, depth and configuration to suit material and construction type where installed.
 - 2. Frame Flange: Provide at units installed in concrete, masonry, and gypsum board.
 - 3. Exposed Joints in Flange: Weld and grind smooth.
- C. Hinge:
 - 1. Concealed spring hinge, 175 degrees of opening.
 - 2. Removable hinge pin to allow removal of door panel from frame.
- D. Lock:
 - 1. Flush, screwdriver-operated cam lock.

2.5 ACCESS DOOR, RECESSED PANEL, NON-RATED**A. Door Panel:**

1. 1.2 mm (0.05 inch) thick steel sheet to form a 25 mm (1 inch) deep recessed pan to accommodate installation of acoustical units and other materials where shown in walls and ceiling.
2. Reinforce to prevent sagging.

B. Frame:

1. 1.5 mm (0.06 inch) thick steel sheet of depth and configuration to suit installation in suspension system of ceiling or wall framing.
2. Extend sides of frame to protect edge of acoustical units when door panel is in open position.
3. Provide shims, bushings, clips and other devices necessary for installation.

C. Hinge: Continuous steel hinge with stainless steel pin, or concealed hinge.**D. Lock:**

1. Flush screwdriver-operated cam lock.
2. Plastic sleeve or stainless steel grommet to protect hole made in acoustical unit for screwdriver access to lock.

2.6 FABRICATION - GENERAL**A. Size:** Minimum 600 mm (24 inches) square door unless otherwise shown.**B. Component Fabrication:** Straight, square, flat and in same plane where required.

1. Exposed Edges: Slightly rounded, without burrs, snags and sharp edges.
2. Exposed Welds: Continuous, ground smooth.
3. Welding: AWS D1.3/D1.3M.

C. Locks and Non-Continuous Hinges: Provide in numbers required to maintain alignment of door panel with frame. For fire-rated doors, provide hinges and locks as required by fire test.**D. Anchoring:** Make provisions in frame for anchoring to adjacent construction. Provide anchors in size, number and location on four sides to secure access door to substrate.**2.7 FINISHES****A. Steel Paint Finish:**

1. Powder-Coat Finish: Manufacturer's standard two-coat finish system consisting of the following:

- a. One coat primer.
 - b. One coat thermosetting topcoat.
 - c. Dry-film Thickness: 0.05 mm (2 mils) minimum.
 - d. Color: match adjacent wall.
- B. Stainless Steel Exposed Surfaces: NAAMM AMP 500; No. 4 polished finish.

2.8 ACCESSORIES

- A. Fasteners: Type and size recommended by access door manufacturer, to suit application.
- 1. Stainless Steel Access Doors: Stainless steel fasteners.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- 1. Verify access door locations and sizes provide required maintenance access to installed building services components.
- B. Protect existing construction and completed work from damage.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
- 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical, electrical and conveyor control items concealed in walls and partitions, and concealed above gypsum board and plaster ceilings.
- C. Install fire rated access door according to NFPA 80.
- D. Install fire-rated doors in fire-rated partitions and ceilings.
- E. Install flush access panels in partitions and in gypsum board and plaster ceilings.

3.3 ACCESS DOOR AND FRAME INSTALLATION

- A. Wall Installations: Install access doors in openings with sides vertical.
- B. Ceiling Installations: Install access doors parallel to ceiling suspension grid or room partitions.
- C. Frames without Flanges: Install frame flush with surrounding finish surfaces.

- D. Frames with Flanges: Overlap opening, with face uniformly spaced from finish surface.
- E. Recessed Panel Access Doors: Install with face of surrounding materials flush with door panel installed finish.
- F. Secure frames to adjacent construction with fasteners.
- G. Install type, size and quantity of anchoring device suitable for material surrounding opening to maintain alignment, and resist displacement, during normal use of access door.
- H. Field Painting Primed Access Doors: Comply with the requirements of Section 09 91 00, PAINTING.

3.4 ADJUSTMENT

- A. Adjust hardware so door panel opens freely.
- B. Adjust door when closed so door panel is centered in frame.

- - E N D - -

08 36 13 – OVERHEAD SECTIONAL DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel sectional overhead doors.
- B. Operating hardware and supports.

1.2 RELATED SECTIONS

- A. Section 09910: Finish painting of sectional overhead doors.
 - 1. Clarification: Sectional overhead doors are to be supplied with factory-applied painted finish. After installation, they receive one site-applied coat of finish paint.
- B. Division 16: Power and control wiring for motor-operated doors.

1.3 SYSTEM DESCRIPTION

- A. Supply each overhead coiling door as a complete system produced by one manufacturer, including hardware, accessories, and mounting and installation components.
- B. Wind Loading Performance for Exterior Doors: Capable of withstanding 20 psf (85 mph) wind loading pressure without failure, including permanent deformation and reduction of weather-stripping effectiveness.
- C. Air Infiltration: Maximum 0.08 cfm (0.038 L/s) at 15 mph (24 km/h) when tested per ASTM E283.
- D. Operation-Cycle Requirements: Capable of operating for not less than 10,000 cycles.

1.4 SUBMITTALS - ACTION

- A. Comply with requirements of Section 01330.
- B. Product Data: Each type of sectional overhead door; include information on hardware and finishes.
 - 1. Motors: Show nameplate data and ratings, characteristics, and mounting arrangements.
- C. Shop Drawings: Each type and size of sectional overhead door. Show dimensions, hardware locations, anchorage details, and glazing.

1.5 SUBMITTALS - CLOSEOUT

- A. Operating instructions and maintenance information per Section 01780. Include wiring diagrams for Project installation of electrically operated units.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

- B. Electrical Components: Listed and labeled by UL or other testing agency acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, HANDLING

- A. Comply with requirements of Section 01600.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Proprietary products of Overhead Door Corporation are designated to indicate desired performance, quality level, and appearance. Subject to compliance with requirements, products of the following manufacturers will be acceptable.
 - 1. Clopay Building Products Company; a Griffon Company.
 - 2. Haas Door; a Nofziger Company.
 - 3. Raynor.
 - 4. Wayne-Dalton Corp.
 - 5. Windsor Door; a MAGNATRAX Corporation.

2.2 STEEL DOOR SECTIONS

- A. Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, conforming to ASTM A653/A 653M, G60 (Z180) coating designation.
- B. Basis of Design: Overhead Door Corporation 592 Series “Thermacore.”
 - 1. Description: Insulated steel all welded construction.
 - 2. Nominal Thickness: 2 inches.
 - 3. Panel Height: 24 inches.
 - 4. Exterior Face: Ribbed steel sheet.
 - 5. Interior Face: Steel sheet.
 - 6. Meeting Edges: Interlocking and gasketed weather joints.
 - 7. Insulation: Foamed-in-place polyurethane; minimum R17.
 - 8. Thermal break construction.
 - 9. Vision Panels: Insulating glass in resilient gaskets; standard size.
 - 10. Finish: Factory-applied primer and baked enamel finish; white color.
- C. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type, size, and performance requirements.
 - 1. Base Material: Galvanized steel; ASTM A653/A 653M for minimum G60 (Z180) zinc coating.

- B. Track Reinforcement and Supports: As recommended by Manufacturer for Project applications to anchor, reinforce, and support tracks to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
 - 1. Base Material: Galvanized conforming to ASTM A36/A 36M and ASTM A123/A 123M.
- C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible rubber or neoprene fitted to bottom and top of overhead door.
 - 1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
 - 2. Provide continuous flexible seals at door jambs for weathertight installation.

2.4 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty galvanized steel hinges at each end and intermediate stile.
- C. Rollers: Heavy-duty case-hardened steel rollers with steel ball bearings in case-hardened steel races.
- D. Push/Pull Handles: Galvanized steel lifting handles on interior side of door for emergency and maintenance use.
- E. Slide Bolt: Side-locking bolts that engage through slots in tracks for padlock; located on single-jamb side, operable from inside only.

2.5 COUNTERBALANCE MECHANISM

- A. Counterbalance Mechanism: Torsion spring on cross head shaft with galvanized aircraft type steel lift cables; springs rated for minimum 10,000 cycles.
 - 1. Maximum 25 lb effort for manual operation when power operator is not used.
- B. Cable Safety Device: Include spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side that automatically stops door if either cable breaks.
- C. Brackets: Provide anchor support brackets to connect stationary end of spring to wall, to level shaft, and to prevent sag.
- D. Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.6 ELECTRIC DOOR OPERATORS AND CONTROLS

- A. General: Provide electric door operator components of size and capacity recommended and provided by door manufacturer for specified door and operation-cycle requirements.
- B. Disconnect Device: Hand-operated disconnect device or mechanism for automatically engaging chain-and-sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Provide interlock device to automatically prevent motor from operating when emergency operator is engaged.
- C. Provide control equipment conforming to NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70, Class 2 control circuit, maximum 24-V, AC or DC.

- D. Electric Motors: High-starting torque, reversible, continuous-duty, Class A insulated, electric motors conforming to NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.
 - 1. Type: Polyphase, medium-induction type.
 - 2. Service Factor: NEMA MG 1, unless otherwise indicated.
 - 3. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
- E. Control Stations: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
 - 1. Provide one interior station per door adjacent to door.
 - 2. Provide full-guarded, surface-mounted, heavy-duty-type interior unit with general-purpose, NEMA ICS 6, Type 1 enclosure.
- F. Safety Edge: Electro-mechanical type; full width along bottom edge; wired to stop and reverse door operation upon contacting obstructions.
- G. Limit Switches: Adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Comply with requirements of Section 01700.
- B. Set doors with panels plumb and parallel to plane of wall.
- C. Anchor door track and operating equipment rigidly and securely to structure without distortion.
- D. Space vertical track supports maximum 24 inches apart.
- E. Hang horizontal and sloped track from structural overhead framing with angle or channel hangers fastened to framing by welding or bolting or both.
- F. Provide sway bracing, diagonal bracing, and reinforcement for door track and operating equipment to prevent movement during door operation.
- G. Place fasteners and anchorage devices so they are not accessible from the exterior when door is in closed position.
- H. Mount disconnect device and operator to be accessible from floor level.
- I. Lubricate bearings and sliding parts.
- J. Start-Up: Engage factory-authorized service representative to perform start-up.
 - 1. Complete installation and startup checks per manufacturer's written instructions.
 - 2. Test and adjust controls and safeties.
 - 3. Replace damaged and malfunctioning controls and equipment.

3.2 ADJUSTING

- A. Adjust hardware for smooth, quiet operation, and secure locking.
- B. Adjust weatherstripping to provide continuous closure and uniform moderate pressure when door is closed.

3.3 CLEANING

- A. Remove labels and visible markings.
- B. Wash vision panels on both sides shortly before inspection for Substantial Completion.

3.4 DEMONSTRATION

- A. Demonstrate door operation and maintenance to Owner's staff.

END OF SECTION

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8 7 11 0 0 - DOOR HARDWARE**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. Mechanical door hardware for the following:
 - a. Swinging doors.
- 2. Cylinders for door hardware specified in other Sections.
- 3. Electrified door hardware.

- B. Related Sections:

- 1. Division 08 Section "Hollow Metal Doors and Frames" for astragals provided as part of labeled fire-rated assemblies and for door silencers provided as part of hollow-metal frames].
- 2. Division 08 Section "Flush Wood Doors" for astragals and integral intumescent seals provided as part of labeled fire-rated assemblies.
- 3. Division 08 Section "Overhead Coiling Doors" for door hardware provided as part of overhead door assemblies.
- 4. Division 08 Section "Sound Control Door Assemblies" for hinges and gasketing provided as part of sound-rated door assemblies.
- 5. Division 10 Section "Wall and Door Protection" for plastic door protection units that match wall protection units.
- 6. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security system.
- 7. Division 28 Section "Digital, Addressable Fire-Alarm System" for connections to building fire-alarm system.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:

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1. Wiring Diagrams: For power, signal, and control wiring and including the following:
 - a. Details of interface of electrified door hardware and building safety and security systems.
 - b. Schematic diagram of systems that interface with electrified door hardware.
 - c. Point-to-point wiring.
 - d. Risers.
 - e. Elevations doors controlled by electrified door hardware.
 2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.
- D. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.
1. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.
 - a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- E. Other Action Submittals:
1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - d. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.

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- 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - 5) Fastenings and other pertinent information.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) List of related door devices specified in other Sections for each door and frame.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.
- F. Qualification Data: For Architectural Hardware Consultant.
- G. Product Certificates: For electrified door hardware, from the manufacturer.
1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- H. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- I. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- J. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Supplier Qualifications: Supplier shall be a member in good standing of the Door and Hardware Institute (DHI).
1. Supplier shall employ an active Architectural Hardware Consultant (AHC), who shall supervise this project and certify that hardware has been supplied in accordance with all local building codes and will function properly.
- C. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

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1. For door hardware, an Architectural Hardware Consultant (AHC).
- D. Source Limitations: Obtain each type of door hardware from a single manufacturer.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- E. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of **0.3 cfm/sq. ft.** (**3 cu. m per minute/sq. m**) at the tested pressure differential of **0.3-inch wg (75 Pa)** of water.
- G. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- H. Means of Egress Doors: Latches do not require more than **15 lbf (67 N)** to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than **5 lbf (22.2 N)**.
 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: **5 lbf (22.2 N)** applied perpendicular to door.
 - b. Sliding or Folding Doors: **5 lbf (22.2 N)** applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than **1/2 inch (13 mm)** high.
 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point **3 inches (75 mm)** from the latch, measured to the leading edge of the door.
- J. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

K. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.6 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Delayed-Egress Locks: Five years from date of Substantial Completion.
 - b. Exit Devices: Two years from date of Substantial Completion.
 - c. Manual Closers: 10 years from date of Substantial Completion.
 3. Factory direct order number shall be provided for each shipment of locks, closers and exit devices with warranty, prior to final payment.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

1.9 EXTRA MATERIALS

- A. Not used.

PART 2 - PRODUCTS**2.1 SCHEDULED DOOR HARDWARE**

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hager Companies.
 - b. IVES Hardware; an Ingersoll-Rand company.
 - c. Stanley Commercial Hardware; Div. of The Stanley Works.
 2. Provide 1-1/2 pair butts per door for doors up to 7'-6" in height. Doors over 7'-6" in height shall have two (2) pairs of butts.
 3. Butt size requirements:
 1. Interior doors up to 37" wide 4-1/2 x 4-1/2.
 2. Interior doors over 37" wide 5 x 4-1/2.
 3. Exterior doors 5 x 4-1/2.
 4. Door butt legend: (unless otherwise noted in Schedule)
 1. Exterior doors BB1199 - NRP.
 2. Interior doors BB1279
 5. Furnish UL approved butts on labeled doors.

2.3 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum ~~0.120-inch-~~ (3.0-mm-) thick, hinge leaves with minimum overall width of ~~4 inches~~ (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hager Companies.
 - b. Select Products Limited.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
 - 2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
 - 3. Deadbolts: Minimum 1-inch (25-mm) bolt throw.
- C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.
- D. Lock Trim:
 - 1. Description: Schlage AL-Series and ND-Series.
 - 2. Levers: AL-Saturn and ND-Rhodes.
 - 3. Operating Device: Lever with escutcheons (roses).
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Bored Locks: BHMA A156.2; Grade 1 and 2; Series 4000.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - b. Schlage Commercial Lock Division; an Ingersoll-Rand company.

2.5 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Von Duprin; an Ingersoll-Rand company.

2.6 ELECTROMAGNETIC LOCKS

- A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Schlage Commercial Lock Division; an Ingersoll-Rand company.
 - b. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
 - c. Security Door Controls.
- B. Delayed-Egress Electromagnetic Locks: BHMA A156.24, electrically powered, with electromagnet attached to frame and armature plate attached to door; depressing push bar for more than 3 seconds initiates irreversible alarm and 15-second delay for egress. When integrated with fire alarm, fire alarm voids 15-second delay.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Schlage Commercial Lock Division; an Ingersoll-Rand company.
 - b. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
 - c. Security Door Controls.

2.7 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hiawatha, Inc.
 - b. IVES Hardware; an Ingersoll-Rand company.
 - c. Trimco.

2.8 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hiawatha, Inc.
 - b. IVES Hardware; an Ingersoll-Rand company.
 - c. Trimco.

2.9 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Precision Hardware, Inc.; Division of Stanley Security Solutions, Inc.
 - b. Von Duprin; an Ingersoll-Rand company.

2.10 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - b. Schlage Commercial Lock Division; an Ingersoll-Rand company.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.
- C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.11 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
 - 1. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
 - 2. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
 - 3. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."
 - 2. Quantity: In addition to one extra key blank for each lock, provide the following:
 - a. Cylinder Change Keys: Three.
 - b. Master Keys: Five.
 - c. Grand Master Keys: Five.
 - d. Great-Grand Master Keys: Five.

2.12 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lund Equipment Co., Inc.
 - b. MMF Industries.
 - 2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
- B. Key Lock Boxes: Designed for storage of two.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GE Security, Inc.
 - b. HPC, Inc.
 - c. Knox Company.

2.13 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; bronze, unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hager Companies.
 - b. IVES Hardware; an Ingersoll-Rand company.
 - c. Rockwood Manufacturing Company.

2.14 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

2.15 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with

manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
 - b. LCN Closers; an Ingersoll-Rand company.

2.16 CLOSER HOLDER RELEASE DEVICES

- A. Closer Holder Release Devices: BHMA A156.15; Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on interruption of signal to release device. Automatic release is activated by smoke detection system or loss of power.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. LCN Closers; an Ingersoll-Rand company.
 - c. Rixson Specialty Door Controls; an ASSA ABLOY Group company.

2.17 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. Hager Companies.
 - c. IVES Hardware; an Ingersoll-Rand company.
 - d. Rockwood Manufacturing Company.

2.18 ELECTROMAGNETIC STOPS AND HOLDERS

- A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted electromagnetic single and floor-mounted electromagnet single unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. LCN Closers; an Ingersoll-Rand company.
 - c. Rixson Specialty Door Controls; an ASSA ABLOY Group company.

2.19 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. Glynn-Johnson; an Ingersoll-Rand company.
 - c. Rockwood Manufacturing Company.
 - d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.20 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hager Companies.
 - b. National Guard Products.
 - c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
 - d. Reese Enterprises, Inc.

2.21 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hager Companies.
 - b. National Guard Products.
 - c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
 - d. Reese Enterprises, Inc.

2.22 NOT USED**2.23 METAL PROTECTIVE TRIM UNITS**

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick bronze; with manufacturer's standard machine or self-tapping screw fasteners.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. IVES Hardware; an Ingersoll-Rand company.
 - b. Rockwood Manufacturing Company.
 - c. Trimco.

2.24 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hager Companies.
 - b. Rockwood Manufacturing Company.
 - c. Stanley Commercial Hardware; Div. of The Stanley Works.

2.25 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Fire-Rated Applications:

- a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
- b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
- 3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
- 4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
- 5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.26 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every **30 inches (750 mm)** of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every **30 inches (750 mm)** of door height greater than **90 inches (2286 mm)**.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
 - 2. Furnish permanent cores to Owner for installation.
- F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
 - 1. Configuration: Provide one power supply for each door opening with electrified door hardware.
- H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

- I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 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.
 - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

- A. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated. Provide positive latching and self closing, regardless if specified in sets.
- B. Items of hardware not definitely specified herein but necessary for completion of the work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to the adjacent hardware. Where size and shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required.
- C. Include such nuances as strike type, strike lip length, raised barrel hinges, mounting brackets, blade stop spacers, special templates, fasteners, shims, and coordination between conflicting products. All doors shall be provided with a stop.
- D. See Sheet A800 for Hardware Groups.

END OF SECTION 087100

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SECTION 08 71 13
AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Automatic operators for swinging doors.

1.2 RELATED REQUIREMENTS

- A. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- B. Access Control Devices: Division 28, ELECTRONIC SAFETY AND SECURITY.
- C. Electric General Wiring, Connections and Equipment Requirements:
Division 26, ELECTRICAL.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - 1. B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. A1008/A1008M-15 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.
- C. Builders Hardware Manufacturers Association (BHMA):
 - 1. BHMA A156.10-11 - Power Operated Pedestrian Doors.
- D. National Fire Protection Association (NFPA):
 - 1. 101-15 - Life Safety Code.
- E. Underwriters Laboratories (UL):
 - 1. 325-13 - Standard for Doors, Drapery, Gate, Louver, and Window Operators and Systems.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Installation instructions.
 - 3. Warranty.
- D. Test reports: Certify each product complies with specifications.
- E. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.
2. Start-up, maintenance, troubleshooting, emergency, and shut-down instructions for each operational product.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 1. Regularly manufactures specified products.
 2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
 - a. Provide contact names and addresses for completed projects when requested by Contracting Officer's Representative.
- B. Installer's Qualifications: Experienced installer, approved by the manufacturer.

1.6 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant automatic door operators against material and manufacturing defects.
 1. Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Comply with requirements of BHMA A156.10. Unless otherwise indicated on Drawings, provide operators that move doors from fully closed to fully opened position in five seconds maximum time interval, when speed adjustment is at maximum setting.
- B. Equipment: Conforming to UL 325. Provide key operated power disconnect wall switch for each door installation.
- C. Electrical Wiring, Connections and Equipment: Motors, starters, controls, associated devices, and interconnecting wiring required for installation. Equipment and wiring as specified in Division 26, ELECTRICAL.

2.2 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES. By manufacturer of existing openers on site.
- B. Provide door operators from one manufacturer.
- C. Provide one type of operator throughout project.

2.3 SWING DOOR OPERATORS

A. General:

1. Type: Institutional type.
2. Size: As recommended by manufacturer for door weight and sizes.

B. Function:

1. Provide operators, enclosed in housing, permitting opening of door by energizing motor and stopped by electrically reducing Voltage and stalling motor against mechanical stop.
2. Door to close by means of spring energy, and closing force controlled by gear system and motor being used as dynamic brake without power, or controlled by hydraulic closer in electro-hydraulic operators.
3. Opening and Closing Speeds: Field adjustable.
4. Operators with checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle.
5. Operators capable of recycling doors instantaneously to full open position from any point in closing cycle when control switch is activated.
6. When automatic power is interrupted or shut-off, permit doors to easily open manually without damage to automatic operator system.

C. Connect hardware with drive arm attached to door with pin linkage rotating in a self-lubricating bearing. Prevent doors from pivoting on shaft of operator.

D. Operator Housing:

1. ASTM B209, Type 6063-T5 aluminum alloy, 112 mm (4-1/2 inches) wide by 140 mm (5.5 inches) high by 3.2 mm (0.125 inch) thick, aluminum extrusions with enclosed end caps for application to 100 mm (4 inches) and larger frame systems.

E. Power Operator:

1. Completely assembled and sealed unit including gear drive transmission, mechanical spring and bearings, located in aluminum case and filled with special lubricant for extreme temperature conditions. Rubber mounted units with provisions for easy maintenance and replacement, without removing door from pivots or frame.

F. Motors:

1. Provide with interlock to prevent operation when doors are electrically locked from opening.

G. Electrical Control:

1. Self-contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation and switching of power operator.
2. Connecting Harnesses: Interlocking plugs.

H. Accessories:

1. Metal mounting supports, brackets and other accessories necessary for installation of operators at head of door frames.

I. Microprocessor Controls:

1. Multi-function microprocessor control providing adjustable hold open time (1-30 seconds) with fully adjustable opening speed, LED indications for sensor input signals and operator status and power assist close options. Control capable of receiving activation signals from any device with normally open dry contact output.
2. Hold doors held open by low Voltage applied to the continuous duty motor.
3. Controls:
 - a. Adjustable safety circuit that monitors door operation and stops opening direction of door if obstruction is sensed.
 - b. Recycle feature that reopens door if obstruction is sensed at any point during closing cycle.
 - c. Standard three position key switch with functions for ON, OFF, and HOLD OPEN, mounted on operator enclosure, door frame, or wall, as indicated on drawings.

2.4 POWER UNITS

- A. Self-contained, electric operated and independent of door operator.
1. Capacity and size of power circuits according to automatic door operator manufacturer's specifications and Division 26 - ELECTRICAL.

SPEC WRITER NOTES: Provide schedule for safety devices selected on drawings.

2.5 DOOR CONTROLS

- A. Control Devices: BHMA A156.10; control opening and closing functions.
- B. Open doors when control device is actuated; hold doors in open positions; then, close doors after a set time established by Owner, unless safety device or reactivated control interrupts operation.
- C. Manual Controls:

1. Push Plate Wall Switch: Recessed type, stainless steel push plate minimum 100 mm by 100 mm (4 inch by 4 inch), with 13 mm (1/2 inch) high letters "To Operate Door-Push" engraved on face of plate.

2.6 SAFETY DEVICES

- A. Swing Doors: Install presence sensor on pull side of door to detect any person standing in door swing path and prevent door from opening.
 1. Time delay Switches: Adjustable between 3 to 60 seconds and control closing cycle of doors.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
 1. Verify door opening is correctly sized and within acceptable tolerances.
- B. Protect existing construction and completed work from damage.

3.2 INSTALLATION

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Coordinate door installation with other related work.
- C. Install manual controls and power disconnect switches recessed or semi-flush mounted in partitions.
- D. Secure operator components to adjacent construction with suitable fastenings.
- E. Conceal conduits, piping, and electric equipment, in finish work.
- F. Install power units in locations shown.
 1. Where units are mounted on walls, provide metal supports or shelves for units.
 2. Ensure equipment, including time delay switches, are accessible for maintenance and adjustment.
- G. Ensure operators are adjusted and function properly for type of expected traffic.
- H. Synchronize each leaf of pair doors to open and close simultaneously. Permit each door leaf to be opened manually, independent of other door leaf.

- I. Install controls at positions shown and ensuring convenience for expected traffic.
- J. Push Plate Wall Switches Mounting Height: 1000 mm (40 inches) maximum.

3.3 DEMONSTRATION AND TRAINING

- A. Instruct facility personnel in proper automatic door operator operation and maintenance.

- - E N D - -

SECTION 08 80 00 - GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors.
 - 2. Glazed entrances.
 - 3. Interior glazing.
- B. Related Sections include the following:
 - 1. Division 08 Section "Flush Wood Doors."
 - 2. Division "08 All Glass Entrances"

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
- F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining

and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: 51 lb f/sq. outward, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
 - b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 60 seconds or less.
 - c. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
 - 1) For monolithic-glass lites heat treated to resist wind loads.
 - 2) For insulating glass.
 - 3) For laminated-glass lites.
 - d. Minimum Glass Thickness for Exterior Lites: Not less than ¼ inch.
 - e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch- square Samples for glass and of 12-inch- long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- C. Samples: For the following products, in the form of 12-inch- square Samples for glass.
 1. Insulating glass for each designation indicated.
 2. For each color (except black) of exposed glazing sealant indicated.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
 1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- F. Qualification Data: For installers.
- G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- H. Product Test Reports: For each of the following types of glazing products:
 1. Insulating glass.
 2. Glazing sealants.
 3. Glazing gaskets.
- I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

- B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass and insulating glass.
- C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
 - 1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Glass Testing Agency Qualifications: An independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 - 1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- G. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
 - 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 - 4. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
- H. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

- I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified in other part 2 sections.

2.2 GLASS PRODUCTS

- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.
 - a. Products:
 - 1) AFG Industries Inc.; Krystal Klear.
 - 2) Pilkington Building Products North America; Optiwhite.
 - 3) PPG Industries, Inc.; Starphire.
 - 4) Approved Product.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
 2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 3. For uncoated glass, comply with requirements for Condition A.
 4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
 5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
- C. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.

3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - a. Manufacturer's standard sealants.
 - b. Polyisobutylene and polysulfide.
 - c. Polyisobutylene and silicone.
 - d. Polyisobutylene and hot-melt butyl.
 - e. Polyisobutylene and polyurethane.
5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
 - a. Spacer Material: Aluminum with bronze, color anodic finish.
 - b. Desiccant: Molecular sieve or silica gel, or blend of both.
 - c. Corner Construction: Manufacturer's standard corner construction.

2.3 GLAZING GASKETS

- A. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
 1. Neoprene.
 2. EPDM.
 3. Silicone.
 4. Thermoplastic polyolefin rubber.
 5. Any material indicated above.

2.4 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

2.5 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
 - 1. Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.8 MONOLITHIC FLOAT-GLASS UNITS

- A. Uncoated Clear Float-Glass Units: Class 1 (clear) Kind FT (fully tempered) float glass.

2.9 INSULATING-GLASS UNITS

- A. Passive Solar Low-E Insulating-Glass Units:

- 1. Products:
 - a. PPG & AFG Low-e Products.
- 2. Overall Unit Thickness and Thickness of Each Lite: 1 inch, 0.25 inch.
- 3. Interspace Content: Argon.
- 4. Outdoor Lite: Class 2 (tinted) float glass.
 - a. Tint Color: Bronze.
 - b. Kind FT (fully tempered).
 - c. Self-Cleaning, Low-Maintenance Coating: Pyrolytic coating on first surface.
- 5. Indoor Lite: Class 1 (clear) float glass.
 - a. Kind FT (fully tempered).
- 6. Low-E Coating: Pyrolytic on second surface.
- 7. Winter Nighttime U-Factor: 0.35 maximum.
- 8. Summer Daytime U-Factor: 0.38 maximum.
- 9. Solar Heat Gain Coefficient: 0.61 maximum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00

SECTION 092900 - GYPSUM BOARD

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. Interior gypsum board.
 - 2. Exterior gypsum board for ceilings and soffits.
 - 3. Tile backing panels.
- B. Related Sections include the following:
 - 1. Division 05 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
 - 2. Division 06 Section "Sheathing" for gypsum sheathing.
 - 3. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
 - 4. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board.
 - 5. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
 - 6. Division 09 Section "Gypsum Board Shaft-Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
 - 7. Division 09 Section "Tiling" for cementitious backer units installed as substrates for ceramic tile.
 - 8. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch long length for each trim accessory indicated.
 - 2. Textured Finishes: for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

- A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum Co.
 - b. BPB America Inc.
 - c. G-P Gypsum.
 - d. Lafarge North America Inc.
 - e. National Gypsum Company.
 - f. PABCO Gypsum.
 - g. Temple.
 - h. USG Corporation.

B. Type Regular & X:

1. Thickness: 5/8 inch .
2. Long Edges: Tapered and featured beveled for prefilling.

C. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch.
2. Long Edges: Tapered.

D. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

E. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

F. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

2.3 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Gypsum Co.
- b. BPB America Inc.
- c. G-P Gypsum.
- d. Lafarge North America Inc.
- e. National Gypsum Company.
- f. PABCO Gypsum.
- g. Temple.
- h. USG Corporation.

B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum.
2. Core: as specified on the drawings

2.4 TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Gypsum Co.
- b. BPB America Inc.
- c. G-P Gypsum.
- d. Lafarge North America Inc.
- e. National Gypsum Company.
- f. PABCO Gypsum.
- g. Temple.
- h. USG Corporation.

3. Core: 5/8 inch, Type X

B. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. USG Corporation; DUROCK Cement Board.

3. Thickness: as shown on the drawings.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
3. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.

3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use setting-type sandable topping compound.
 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
 2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
- E. Joint Compound for Tile Backing Panels:
1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
 2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 3. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
- F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."
- G. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

2.8 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested according to ASTM E 84.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. G-P Gypsum; Georgia-Pacific Regency Ceiling Textures/Polystyrene.
 - b. National Gypsum Company; Perfect Spray.
 - c. USG Corporation; SHEETROCK Ceiling Spray Texture, QT.
 - 3. Texture: Fine.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.

- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Regular Type: As indicated on Drawings.
 - 2. Type X: As indicated on Drawing.
 - 3. Type C: As indicated on Drawings.
 - 4. Flexible Type: As indicated on Drawings.
 - 5. Ceiling Type: As indicated on Drawings.
 - 6. Abuse-Resistant Type: As indicated on Drawings.
 - 7. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying face layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, **16 inches** minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
 - 1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
 - 2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: Install where indicated on the drawings. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- C. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
- D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. Bullnose Bead: Use where indicated.
 - 3. LC-Bead: Use at exposed panel edges.
 - 4. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.

3.7 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joint, rounded or beveled edges, and damaged surface areas.

- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Panels that are substrate for vinyl wall coverings.
 - 4. Level 4: Back of house and non-public areas.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
 - 5. Level 5: All public areas.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.9 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 09 30 13
CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies interior ceramic tile, marble thresholds, crack isolation membranes and tile backer board.

1.2 RELATED WORK:

- C. Sealing of Joints: Section 07 92 00, JOINT SEALANTS.
- D. Color, Texture, Pattern, and Size of Field Tile and Trim Shapes, and Color of Grout Specified: Room Finish Schedule.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Samples:
 - 1. Base tile, each type, each color, each size.
 - 2. Mosaic floor tile panels, 228 by 228 mm (9 by 9 inches), each type, color, size and pattern.
 - 3. Wall (or wainscot) tile, each color, size and pattern.
 - 4. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.
- D. Product Data:
 - 1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
 - 2. Chemical resistant mortar and grout (epoxy and furan).
 - 3. Cementitious backer unit.
 - 4. Dry-set portland cement mortar and grout.
 - 5. Divider strip.
 - 6. Elastomeric membrane and bond coat.
 - 7. Reinforcing tape.
 - 8. Leveling compound.
 - 9. Latex-portland cement mortar and grout.
 - 10. Commercial portland cement grout.
 - 11. Organic adhesive.
 - 12. Slip resistant tile.
 - 13. Waterproofing isolation membrane.
 - 14. Fasteners.

E. Certification:

1. Master grade certificate, ANSI A137.1.
2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
 - a. Chemical resistant mortar and grout (epoxy and furan).
 - b. Modified epoxy emulsion.
 - c. Commercial portland cement grout.
 - d. Cementitious backer unit.
 - e. Dry-set portland cement mortar and grout.
 - f. Elastomeric membrane and bond coat.
 - g. Reinforcing tape.
 - h. Latex-portland cement mortar and grout.
 - i. Leveling compound.
 - j. Organic adhesive.
 - k. Waterproof isolation membrane.
 - l. Factory back mounted tile documentation for suitability for application in wet area.

F. Installer Qualifications:

1. Submit letter stating installer's experience.

1.4 DELIVERY AND STORAGE:

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

1.5 QUALITY ASSURANCE:

- A. Installers to be from a company specializing in performing installation of products specified and have a minimum of three (3) years' experience.
- B. Each type and color of tile to be provided from a single source.
- C. Each type and color of mortar, adhesive, and grout to be provided from the same source.

1.6 WARRANTY:

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.

B. American National Standards Institute (ANSI):

- A10.20-06(R2011).....Safe Operating Practices for Tile, Terrazzo and
Marble WorkA108/A118/A136-14 Installation of
Ceramic Tile
- A108.01-13.....Subsurfaces and Preparations by Other Trades
- A108.02-13.....Materials, Environmental, and Workmanship
- A108.1A-14.....Installation of Ceramic Tile in the Wet-Set
Method with Portland Cement Mortar
- A108.1B-10.....Installation of Ceramic Tile on a Cured
Portland Cement Mortar Setting Bed with Dry-Set
or Latex-Portland Cement Mortar
- A108.1C-10.....Contractors 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
- A108.4-09.....Ceramic Tile with Organic Adhesives or Water
Cleanable Tile-Setting Epoxy Adhesive
- A108.6-10.....Ceramic Tile with Chemical Resistant, Water
Cleanable Tile-Setting and -Grouting Epoxy
- A108.8-10.....Ceramic Tile with Chemical Resistant Furan
Resin Mortar and Grout
- A108.10-10.....Grout in Tilework
- A108.13-10.....Load Bearing, Bonded, Waterproof Membranes for
Thin-Set Ceramic Tile and Dimension Stone
- A118.1-12.....Dry-Set Portland Cement Mortar
- A118.3-13.....Chemical Resistant, Water Cleanable Tile-
Setting and -Grouting Epoxy and Water Cleanable
Tile-Setting Epoxy Adhesive
- A118.4-12.....Latex-Portland Cement Mortar
- A118.5-10.....Chemical Resistant Furan Mortars and Grouts
- A118.6-10.....Cement Grouts for Tile Installation
- A118.7-10.....High Performance Cement Grouts for Tile
Installation
- A118.9-10.....Cementitious Backer Units
- A118.10-14.....Load Bearing, Bonded, Waterproof Membranes for
Thin-Set Ceramic Tile and Dimension Stone
Installation

A136.1-13.....Organic Adhesives for Installation of Ceramic
Tile

A137.1-12.....American National Standard Specifications for
Ceramic Tile

C. ASTM International (ASTM):

A666-10.....Annealed or Cold-Worked Austenitic Stainless
Steel Sheet, Strip, Plate and Flat Bar

A1064/A1064M-14.....Carbon-Steel Wire and Welded Wire
Reinforcement, Plain and Deformed, for Concrete

C109/C109M-13.....Standard Test Method for Compressive Strength
of Hydraulic Cement Mortars (Using 2 inch. or
[50-mm] Cube Specimens)

C241/C241M-13.....Abrasion Resistance of Stone Subjected to Foot
Traffic

C348-14.....Standard Test Method for Flexural Strength of
Hydraulic-Cement Mortars

C627-10.....Evaluating Ceramic Floor Tile Installation
Systems Using the Robinson-Type Floor Tester

C954-11.....Steel Drill Screws for the Application of
Gypsum Board on Metal Plaster Base to Steel
Studs from 0.033 in (0.84 mm) to 0.112 in (2.84
mm) in thickness

C979/C979M-10.....Pigments for Integrally Colored Concrete

C1002-14.....Steel Self-Piercing Tapping Screws for the
Application of Panel Products

C1027-09.....Test Method for Determining Visible Abrasion
Resistance of Glazed Ceramic Tile

C1127-01(R2009).....Standard Guide for Use of High Solids Content,
Cold Liquid-Applied Elastomeric Waterproofing
Membrane with an Integral Wearing Surface

C1178/C1178M-13.....Standard Specification for Coated Glass Mat
Water-Resistant Gypsum Backing Panel

C1325-14.....Non-Asbestos Fiber-Mat Reinforced Cementitious
Backer Units

C1353/C1353M-09(R2013).....Abrasion Resistance of Dimension Stone
Subjected to Foot Traffic Using a Rotary
Platform, Double-Head Abraser

- D1204-14.....Test Method for Linear Dimensional Changes of
Nonrigid Thermoplastic Sheeting or Film at
Elevated Temperature
- D2240-05(R2010).....Test Method for Rubber Property - Durometer
Hardness
- D2497-07(R2012).....Tolerances for Manufactured Organic-Base
Filament Single Yarns
- D3045-92(R2010).....Heat Aging of Plastics Without Load
- D4397-10.....Standard Specification for Polyethylene
Sheeting for Construction, Industrial and
Agricultural Applications
- D5109-12.....Standard Test Methods for Copper-Clad
Thermosetting Laminates for Printed Wiring
Boards
- D. Code of Federal Regulation (CFR):
- 40 CFR 59.....Determination of Volatile Matter Content, Water
Content, Density Volume Solids, and Weight
Solids of Surface Coating
- E. Marble Institute of America (MIA): Design Manual III-2007
- F. Tile Council of North America, Inc. (TCNA):
- Handbook for Ceramic Tile Installation (2014)
- DCOF AcuTest-2012.....Dynamic Coefficient of Friction Test

PART 2 - PRODUCTS

2.1 TILE:

- A. Comply with ANSI A137.1, Standard Grade, except as modified:
1. Inspection procedures listed under the Appendix of ANSI A137.1.
 2. Abrasion Resistance Classification:
 - a. Tested in accordance with values listed in Table 1, ASTM C1027.
 - b. Class V, 12000 revolutions for floors in Corridors, Kitchens,
Storage including Refrigerated Rooms
 - c. Class IV, 6000 revolutions for remaining areas.
 3. Slip Resistant Tile for Floors:
 - a. Coefficient of friction, when tested in accordance with
ANSI A137.1 and measured per the TCNA DCOF AcuTest.
 - 1) Equal to or greater than .42 for level interior tile floors
that will be walked on when wet.

7. Factory-Applied Temporary Protective Coating:
 - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of hot applied petroleum paraffin wax.
 - b. Do not coat unexposed tile surfaces.
 - c. Pre-wax tiles set or grouted with // furan or epoxy // // or latex modified mortars //.
- D. Glazed Wall Tile: Cushion edges, glazing.
- E. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, with cushion edges. Porcelain tile produced by the dust pressed method are to be made of approximately 50% feldspar; the remaining 50% is to be made up of various high-quality light firing ball clays yielding a tile with a water absorption rate of 0.5% or less and a breaking strength of between 176 to 181 kg (390 to 400 lbs.).
- F. Trim Shapes:
 1. Conform to applicable requirements of adjoining floor and wall tile.
 2. Use trim shapes sizes conforming to size detailed on construction documents or specified otherwise.
4. Internal and External Corners:
 - a. Square internal and external corner joints are not acceptable.
 - b. External corners including edges: Use bullnose shapes.
 - c. Internal corners: Use cove shapes.
 - d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
 - e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
 - f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
 - g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.
 - h. For unglazed ceramic mosaic and glazed wall tile installed in portland cement mortar setting bed, use cove and bullnose shapes as applicable. When ceramic mosaic wall and base tile is required, use C Series cove and bullnose shapes.
 - i. For unglazed ceramic mosaic and glazed wall tile installed in dry-set portland cement mortar, latex-portland cement mortar, and

organic adhesive (thin set methods), use cove and surface
bullnose shapes as applicable.

- j. For quarry tile work, use cove and bullnose shapes as applicable.
- k. Provide cove and bullnose shapes where indicated in construction documents, and required to complete tile work.

2.2 BACKER UNITS:

A. Cementitious Backer Units:

- 1. Use in showers or wet areas.
- 2. Conform to ASTM C1325; Type A.
- 3. Use in maximum lengths available to minimize end to end butt joints.

2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS:

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-portland cement mortar complying with ANSI A108.01.
- C. Joint material, including reinforcing tape, and tape embedding material, are to be as specifically recommended by the backer unit manufacturer.

2.4 FASTENERS:

A. Screws for Cementitious Backer Units.

- 1. Standard screws for gypsum board are not acceptable.
- 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
- 3. ASTM C954 for steel 1 mm (0.033 inch) thick.
- 4. ASTM C1002 for steel framing less than 0.0329 inch thick.

B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

2.5 SETTING MATERIALS OR BOND COATS:

A. Conform to TCNA Handbook for Ceramic Tile Installation.

B. Portland Cement Mortar: ANSI A108.02.

C. Latex-Portland Cement Mortar: ANSI A118.4.

- 1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.4.
- 2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

- D. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.1.
- E. Organic Adhesives: ANSI A136.1, Type 1.
- F. Chemical-Resistant Bond Coat:
 - 1. Epoxy Resin Type: ANSI A118.3.
 - 2. Furan Resin Type: ANSI A118.5.
 - 5. Manufacturer's standard sheet size with prefabricated or preformed inside and outside corners.
 - 6. Sheet manufacturer's solvent welding liquid or xylene and edge sealant.

2.6 GROUTING MATERIALS:

- A. Coloring Pigments:
 - 1. Pure mineral pigments, lime proof and nonfading, complying with ASTM C979/C979M.
 - 2. Coloring pigments may only be added to grout by the manufacturer.
 - 3. Job colored grout is not acceptable.
 - 4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.
- B. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated. // Zero VOC content. //
- C. Standard Cement Grout: ANSI A118.6.

2.7 PATCHING AND LEVELING COMPOUND:

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Provide a patching and leveling compound with the following minimum physical properties:
 - 1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
 - 2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
 - 3. Tensile strength - 4.1 MPa (600 psi) per ANSI 118.7.
 - 4. Density - 1.9.
- C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 101 mm (4 inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.
- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.

E. Ready for use in 48 hours after application.

2.10 WATER:

A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.11 CLEANING COMPOUNDS:

A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.

B. Materials containing acid or caustic Material are not acceptable.

2.12 FLOOR MORTAR BED REINFORCING:

A. ASTM A1064/A1064M welded wire fabric without backing, MW3 x MW3 (2 x 2-W0.5 x W0.5).

SPEC WRITER NOTE: Use polyethylene sheet to minimize joints and to cover walls in showers and wet areas.

2.13 POLYETHYLENE SHEET:

A. Polyethylene sheet conforming to ASTM D4397.

B. Nominal thickness: 0.15 mm (6 mils).

PART 3 - EXECUTION

SPEC WRITER NOTES:

3.1 ENVIRONMENTAL REQUIREMENTS:

A. Maintain ambient temperature of work areas at not less than 16 degrees C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three (3) days after installation.

B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.

C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).

D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).

E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after third day of completion of tile work.

3.2 ALLOWABLE TOLERANCE:

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
 - 1. Not more than 6 mm in 3048 mm (1/4 inch in 10 feet) from required elevation where portland cement mortar setting bed is used.
 - 2. Not more than 3 mm in 3048 mm (1/8 inch in 10 feet) where dry-set portland cement, and latex-portland cement mortar setting beds and chemical-resistant bond coats are used.
- B. Variation in Plane of Wall Surfaces:
 - 1. Not more than 6 mm in 2438 mm (1/4 inch in 8 feet) from required plane where portland cement mortar setting bed is used.
 - 2. Not more than 3 mm in 2438 mm (1/8 inch in 8 feet) where dry-set or latex-portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION:

- A. Cleaning New Concrete or Masonry:
 - 1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.
 - 2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
 - 3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.
- B. Patching and Leveling:
 - 1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
 - 2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
 - a. Thickness of compound as required to bring finish tile system to elevation shown on construction documents.
 - b. Float finish.
 - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
 - 3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.

4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
- C. Mortar Bed for Slopes to Drains:
1. Slope compound to drain where drains are shown on construction documents.
 2. Install mortar bed in depressed slab sloped to drains not less than 3.2 mm in 305 mm (1/8 inch per foot).
 3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
 4. Screed for slope to drain and float finish.
 5. Cure mortar bed for not less than seven (7) days. Do not use curing compounds or coatings.
 6. Perform flood test to verify mortar bed slopes to drain before installing tile. Contracting Officer Representative (COR) to be present during flood test.
- D. Additional preparation of concrete floors for tile set with epoxy, or furan-resin is to be in accordance with the manufacturer's printed instructions.
- E. Cleavage Membrane:
1. Install polythene sheet as cleavage membrane in depressed slab when waterproof membrane is not scheduled or indicated.
 2. Turn up at edge of depressed floor slab to top of floor.
- F. Walls:
1. In showers or other wet areas cover studs with polyethylene sheet.
 2. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
 3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.

3.4 CEMENTITIOUS BACKER UNITS:

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A118.9 except as specified otherwise.

- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a "V" joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 203 mm (8 inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.
- E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.
- F. Do not install joint treatment for seven (7) days after installation of cementitious backer unit.
- G. Joint Treatment:
 - 1. Fill horizontal and vertical joints and corners with latex-portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
 - 2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

3.5 GLASS MAT WATER-RESISTANT BACKING BOARD:

- A. Install in accordance with manufacturer's instructions.
TCNA Systems W245-1.
- B. Treat joints with tape and latex-portland cement mortar or adhesive. //

3.8 CERAMIC TILE - GENERAL:

- A. Comply with ANSI A108/A118/A136 series of tile installation standards applicable to methods of installation and TCNA Installation Guidelines.
- B. Installing Mortar Beds for Floors:
 - 1. Install mortar bed in a manner that does not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
 - 2. Install floor mortar bed reinforcing centered in mortar fill.
 - 3. Screed finish to level plane or slope to drains shown on construction documents, float finish.
 - 4. For thin set systems cure mortar bed not less than seven (7) days.
Do not use curing compounds or coatings.
 - 5. For tile set with portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.
- C. Setting Beds or Bond Coats:

5. Set wall tile installed over concrete or masonry in dry-set portland cement mortar, or latex-portland cement mortar, ANSI 108.1B and TCNA System W211-14, W221-14 or W222-14.
6. Set wall tile installed over concrete backer board in latex-portland cement mortar, ANSI A108.1B.
7. Set wall tile installed over portland cement mortar bed on metal lath base in portland cement paste over plastic mortar bed, or dry-set portland cement mortar or latex-portland cement mortar over a cured mortar bed, ANSI A108.1C, TCNA System W231-14, W241-14.
8. 9. Set tile installed over gypsum board and gypsum plaster in organic adhesive, ANSI A108.1, TCNA System W242-14.
10. Set trim shapes in same material specified for setting adjoining tile.

D. Workmanship:

1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field. // Align new tile work scheduled for existing spaces to the existing tile work unless specified otherwise.
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise on construction documents.
3. Form intersections and returns accurately.
4. Cut and drill tile neatly without marring surface.
5. Cut edges of tile abutting penetrations, finish, or built-in items:
 - a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
 - b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work is to be free from hollow sounding areas and loose, cracked or defective tile.
7. Remove and reset tiles that are out of plane or misaligned.
8. Floors:
 - a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.

- b. Align finish surface of new tile work flush with other and existing adjoining floor finish where indicated in construction documents.
 - c. In areas where floor drains occur, slope tile to drains.
 - d. Push and vibrate tiles over 203 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
- a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights as indicated in construction documents with tile.
 - b. Finish reveals of openings with tile, except where other finish materials are indicated in construction documents.
 - d. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
10. Joints:
- a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise on construction documents.
 - b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
 - d. Make joints in paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.
11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108/A118/A136 series of tile installation standards:
- a. Tile wall installations in wet areas, including showers, tub enclosures, laundries and swimming pools.
 - b. Tile installed with chemical-resistant mortars and grouts.
 - c. Tile wall installations composed of tiles 203 by 203 mm (8 by 8 inches) or larger.

3.9 CERAMIC TILE INSTALLED WITH PORTLAND CEMENT MORTAR:

- A. Mortar Mixes for Floor, Wall and Base Tile (including Showers):
ANSI A108.1A. except specified otherwise.
- B. Installing Wall and Base Tile: ANSI A108.1A, except specified otherwise.

- C. Installing Floor Tile: ANSI A108.1A, except as specified otherwise.
Slope mortar beds to floor drains at a minimum of 3 mm in 305 mm
(1/8 inch per foot).

3.10 PORCELAIN TILE INSTALLED WITH LATEX PORTLAND CEMENT BONDING MORTAR:

- A. Due to the denseness of porcelain tile use latex portland cement bonding mortar that meets the requirements of ANSI A108.01. Mix bonding mortars in accordance with manufacturer's instructions. Provide liquid ratios and comply with dwell times during the placement of bonding mortar and tile.

3.11 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR:

- A. Installation of Tile: ANSI A108.1B, except as specified otherwise.
- B. Slope tile work to drains at not less than 3 mm in 305 mm (1/8 inch per foot).

3.12 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH ORGANIC ADHESIVE

- A. Installation of Tile: ANSI A108.4.

3.13 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH CHEMICAL-RESISTANT BOND COAT:

- A. Epoxy Resin Type: Install tile in accordance with Installation of Tile with Epoxy Mortar; ANSI A108.6.
- B. Furan Resin Type: Proportion, mix and place in accordance with the manufacturer's printed instructions. Set tile in accordance with ANSI A108.8.

3.15 GROUTING:

- A. Grout Type and Location:
 - 1. Grout for glazed wall and base tile, paver tile and unglazed mosaic tile // except for therapeutic pool // portland cement grout, latex-portland cement grout, dry-set grout, or commercial portland cement grout.
- B. Workmanship:
 - 1. Install and cure grout in accordance with the applicable standard.
 - 2. Sand Portland Cement Grout: ANSI A108.10.
 - 3. Standard Cement Grout: ANSI A118.6.
 - 4. High Performance Grout: ANSI A118.7.
 - 5. Epoxy Grout: ANSI A108.6.
 - 6. Water-Cleanable Epoxy Grout: ANSI A118.3.

7. Furan and Commercial Portland Cement Grout: ANSI A118.5 and in accordance with the manufacturer's printed instructions.

3.16 MOVEMENT JOINTS:

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.
- B. TCNA details EJ 171-14.

3.17 CLEANING:

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used are not permitted to damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with epoxy, furan and commercial portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

3.18 PROTECTION:

- A. Keep traffic off tile floor, until grout and setting material is fully set and cured.
- B. Where traffic occurs over tile floor is unavoidable, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

3.19 TESTING FINISH FLOOR:

- A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

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**SECTION 09 51 00
ACOUSTICAL CEILINGS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Acoustical units.
 - 2. Metal ceiling suspension system for acoustical ceilings.

1.2 RELATED REQUIREMENTS

- A. Color, pattern, and location of each type of acoustical unit: ROOM FINISH SCHEDULE.
- B. Ceiling Suspension System: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - 1. A641/A641M-09a(2014) - Zinc-coated (Galvanized) Carbon Steel Wire.
 - 2. A653/A653M-15e1 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.
 - 3. C423-09a - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 4. C635/C635M-13a - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 5. C636/C636M-13 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 - 6. E84-15b - Surface Burning Characteristics of Building Materials.
 - 7. E119-16 - Fire Tests of Building Construction and Materials.
 - 8. E413-16 - Classification for Rating Sound Insulation.
 - 9. E1264-14 - Classification for Acoustical Ceiling Products.
- C. International Organization for Standardization (ISO):
 - 1. ISO 14644-1 - Classification of Air Cleanliness.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 - 1. Required Participants:
 - a. Tribe Project Manager.
 - b. Contractor.

- c. Installer.
- d. Other installers responsible for adjacent and intersecting work, including sprinkler, HVAC and lighting installers.
- 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Inspecting and testing.
 - i. Other items affecting successful completion.
- 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Ceiling suspension system indicating manufacturer recommendation for each application.
 - 3. Installation instructions.
 - 4. Warranty.
- D. Samples:
 - 1. Acoustical units, 150 mm (6 inches) in size, each type, including units specified to match existing.
 - a. Submit quantity required to show full color and texture range.
 - 2. Suspension system, trim and molding, 300 mm (12 inches) long.
 - 3. Colored markers for access service.
 - 4. Approved samples may be incorporated into work.
- E. Certificates: Certify each product complies products comply with specifications.
 - 1. Acoustical units, each type.

F. Qualifications: Substantiate qualifications comply with specifications.

G. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Regularly manufactures specified products.

1.7 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight, conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Conditions: HVAC systems are complete, operational, and maintaining facility design operating conditions continuously, beginning 48 hours before installation until Government occupancy.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

1.10 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Ceiling System: Acoustical ceilings units on exposed grid suspension systems.

2.2 SYSTEM PERFORMANCE

- A. Design product complying with specified performance:
 - 1. Maximum Deflection: $1/360$ of span, maximum.
- B. Fire Resistance: ASTM E119; as component of 2 hour rated roof-ceiling assembly.
- C. Surface Burning Characteristics: When tested according to ASTM E84.
 - 1. Flame Spread Rating: // 25 // 75 // 200 // maximum.
 - 2. Smoke Developed Rating: 450 maximum.

2.3 PRODUCTS - GENERAL

- A. Basis of Design: ROOM FINISH SCHEDULE.
- B. Ceilings at Elder Services Garage addition to match existing, adjacent corridor from Anna John Nursing Home. ACT Ceiling at corridors at Lodge Garages to match corridor at Elder Lodges.
- C. Provide acoustical units from one manufacturer.
 - 1. Provide each product exposed to view from one production run.
- D. Provide suspension system from same manufacturer.

2.4 ACOUSTICAL UNITS

- A. General:
 - 1. Ceiling Panel and Tile: ASTM E1264, bio-based content according to USDA Bio-Preferred Product requirements.
 - a. Mineral Fiber: 3.6 kg/sq. m ($3/4$ psf) weight, minimum.
 - b. Integrally colored units.
 - 2. Classification: Provide type and form as follows:
 - a. Type III Units - Mineral base with water-based painted finish maximum 10 g/l VOC; Form 2 - Water felted, minimum 16 mm ($5/8$ inch) thick.
 - b. Type IV Units - Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 16 mm ($5/8$ inch) thick. Apply poly (vinyl) chloride over paint coat.
 - c. NRC (Noise Reduction Coefficient): ASTM C423, minimum 0.55.
 - d. CAC (Ceiling Attenuation Class): ASTM E413, 40-44 range.
 - e. LR (Light Reflectance): Minimum 0.75.
 - 3. Lay-in panels: Sizes as indicated on Drawings, with edges matching existing conditions.

2.5 METAL SUSPENSION SYSTEM

- A. General: ASTM C635, intermediate-duty, except as otherwise specified.

1. Suspension System: Provide the following:
 - a. Galvanized cold-rolled steel, bonderized.
 2. Main and Cross Runner: Use same construction Do not use lighter-duty sections for cross runners.
- B. Exposed Grid Suspension System: Support of lay-in panels.
1. Grid Width: 22 mm (7/8 inch) minimum with 8 mm (5/16 inch) minimum panel bearing surface.
 2. Molding: Fabricate from the same material with same exposed width and finish.
 3. Finish: Baked-on enamel flat texture finish.
 - a. Color: To match adjacent acoustical units unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Suspension System Support of Metal Type V, VI, and VII Tiles: Concealed grid type with runners for snap-in attachment of metal tile (pans).
- D. Carrying Channels Secondary Framing: Cold-rolled or hot-rolled steel, black asphaltic paint finish, rust free.
1. Weight per 300 m (per thousand linear feet), minimum:

Size		Cold-rolled		Hot-rolled	
mm	inches	kg	pound	kg	pound
38	1-1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

- E. Anchors and Inserts: Provide anchors or inserts to support twice the loads imposed by hangers.
1. Hanger Inserts: Steel, zinc-coated (galvanized after fabrication).
 - a. Nailing type option for wood forms:
 - 1) Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).
 - 2) Lower portion provided with minimum 8 mm (5/16 inch) hole to permit attachment of hangers.
 - b. Flush ceiling insert type:
 - 1) Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
 - 2) Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.

- 3) Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.

F. Clips: Galvanized steel, designed to secure framing member in place.

G. Tile Splines: ASTM C635.

H. Wire: ASTM A641.

1. Size:

a. Wire Hangers: Minimum diameter 2.68 mm (0.1055 inch).

b. Bracing Wires: Minimum diameter 3.43 mm (0.1350 inch).

2.6 ACCESSORIES

A. Adhesives: Low pollutant-emitting, water based type recommended by adhered product manufacturer for each application.

B. Perimeter Seal: Vinyl, polyethylene or polyurethane open cell sponge material, density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.

1. Thickness: As required to fill voids between back of wall molding and finish wall.

2. Size: Minimum 9 mm (3/8 inch) wide strip.

C. Access Identification Markers: Colored markers with pressure sensitive adhesive on one side, paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) diameter.

1. Color Code: Provide the following color markers for service identification:

Color	Service
Red	Sprinkler System: Valves and Controls
Green	Domestic Water: Valves and Controls
Yellow	Chilled Water and Heating Water
Orange	Ductwork: Fire Dampers
Blue	Ductwork: Dampers and Controls
Black	Gas: Laboratory, Medical, Air and Vacuum

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Remove existing acoustical panels, suspension system to permit new installation.

1. Retain existing acoustical panels and suspension system for reuse.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 ACOUSTICAL UNIT INSTALLATION

- A. Applications:
 1. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Layout acoustical unit // symmetrically, // with minimum number of joints.
- C. Installation:
 1. Install acoustic tiles after wet finishes have been installed and solvents have cured.
 2. Install lay-in acoustic panels in exposed grid with minimum 6 mm (1/4 inch) bearing at edges on supports.
 - a. Install tile to lay level and in full contact with exposed grid.
 - b. Replace cracked, broken, stained, dirty, or tile.
 3. Markers:
 - a. Install color coded markers to identify the various concealed piping, mechanical, and plumbing systems.
 - b. Attach colored markers to exposed grid on opposite sides of the units providing access.
 - c. Attach marker on exposed ceiling surface of upward access acoustical unit.
- D. Touch up damaged factory finishes.
 1. Repair painted surfaces with touch up primer.

3.4 CEILING SUSPENSION SYSTEM INSTALLATION

- A. General: Install according to ASTM C636.
 1. Use direct or indirect hung suspension system or combination of both.
 2. Support a maximum area of 1.48 sq. m (16 sq. ft.) of ceiling per hanger.

3. Prevent deflection in excess of $1/360$ of span of cross runner and main runner.
 4. Provide additional hangers located at each corner of support components.
 5. Provide minimum 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown.
 6. Provide main runners minimum 1200 mm (48 inches) in length.
 7. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.
- B. Direct Hung Suspension System: ASTM C635.
1. Support main runners by hanger wires attached directly to the structure overhead.
 2. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.
- C. Anchorage to Structure:
1. Steel:
 - a. Install carrying channels for attachment of hanger wires.
 - 1) Size and space carrying channels to support load within performance limit.
 - 2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
 - b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fireproofing is installed. Weld or use steel clips for beam attachment.
 - c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.
- D. Indirect Hung Suspension System: ASTM C635.
1. Space carrying channels for indirect hung suspension system maximum 1200 mm (4 feet) on center. Space hangers for carrying channels maximum 2400 mm (8 feet) on center or for carrying channels less

than 1200 mm (4 feet) or center so as to insure that specified requirements are not exceeded.

2. Support main runners by specially designed clips attached to carrying channels.

3.5 CEILING TREATMENT

A. Moldings:

1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.

B. Perimeter Seal:

1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

C. Existing ceiling:

1. Where extension of existing ceilings occurs, match existing.
2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

3.6 CLEANING

- A. Remove excess adhesive before adhesive sets.
- B. Clean exposed surfaces. Remove contaminants and stains.

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SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.
- B. Related Sections:
 - 1. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.
- D. Product Schedule: For resilient products. Refer to Room Finish and Material schedule on Drawings sheet A8.0.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Mockups: Provide resilient products with mockups specified in other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

- A. Resilient Base:
 - 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. Allstate Rubber Corp.; Stoler Industries.
 - b. Armstrong World Industries, Inc.
 - c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
 - d. Endura Rubber Flooring; Division of Burke Industries, Inc.
 - e. Estrie Products International; American Biltrite (Canada) Ltd.
 - f. Flexco, Inc.
 - g. Johnsonite.

- h. Mondo Rubber International, Inc.
- i. Musson, R. C. Rubber Co.
- j. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
- k. PRF USA, Inc.
- l. Roppe Corporation, USA.
- m. VPI, LLC; Floor Products Division.
- n. Approved Manufacturer.

B. Resilient Base Standard: ASTM F 1861.

- 1. Material Requirement: Type TV (vinyl, thermoplastic).
- 2. Manufacturing Method: Group I (solid, homogeneous).
- 3. Style: Cove (base with toe).

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches, unless indicated otherwise on Drawings.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Finish: Matte.

I. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

- 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. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
- b. Flexco, Inc.
- c. Johnsonite.
- d. R.C.A. Rubber Company (The).
- e. Roppe Corporation, USA.
- f. VPI, LLC; Floor Products Division.
- g. Approved Manufacturer.

B. Description: Carpet edge for glue-down applications, Nosing for carpet, Nosing for resilient floor covering, Reducer strip for resilient floor covering, Joiner for tile and carpet, Transition strips.

C. Material: Vinyl.

- D. Profile and Dimensions: As indicated.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Cove Base Adhesives: Not more than 50 g/L.
 - b. Rubber Floor Adhesives: Not more than 60 g/L.
- C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.
- D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.
- E. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
 - 1. Apply two coat(s).
- E. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13

SECTION 096519 - RESILIENT TILE FLOORING

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. Vinyl composition floor tile.
- B. Related Sections:
 - 1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- C. Samples for Initial Selection: For each type of floor tile indicated.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- E. Product Schedule: For floor tile. Use same designations indicated on Drawings.
- F. Qualification Data: For qualified Installer.
- G. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

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. Floor Tile: Furnish 1 box for every [50] <Insert number> boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION FLOOR TILE

- A. Products: Subject to compliance with requirements, design intent per Room Finish Schedule:
1. AB ColorPlus, American Biltrite (Canada) Ltd.;
 2. Armstrong World Industries, Inc.;
 3. Congoleum Corporation;

4. Mannington Mills, Inc.;
 5. Tarkett, Inc.;
 6. Vinylasa Tile, Distributed by American Tile Inc.;
- B. Tile Standard: ASTM F 1066, Class 1, solid-color tile
- C. Wearing Surface: Smooth
- D. Thickness: 0.125 inch (3.2 mm)
- E. Size: 12 by 12 inches (305 by 305 mm).
- F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Vinyl Composition Floor Tile Adhesives: Not more than 50 g/L.
 - b. Rubber Floor Tile Adhesives: Not more than 60 g/L.
- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.
- D. Sealers and Finish Coats for Resilient Terrazzo Floor Tile: Premium-type products as recommended by manufacturer for resilient terrazzo floor tile.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Perform tests recommended by manufacturer[**and as follows**]. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply two coat(s).
- E. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.
- F. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
 - 1. Sealer: Apply two base coats of liquid sealer.
 - 2. Finish: Apply two coats of liquid floor finish.
- G. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

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 modular carpet tile.
- B. Related Sections include the following:
 - 1. Division 02 Section "Selective Structure Demolition" for removing existing floor coverings.
 - 2. Division 09 Section "Sheet Carpeting."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Existing flooring materials to be removed.
 - 3. Existing flooring materials to remain.
 - 4. Carpet tile type, color, and dye lot.
 - 5. Type of subfloor.
 - 6. Type of installation.
 - 7. Pattern of installation.
 - 8. Pattern type, location, and direction.
 - 9. Pile direction.
 - 10. Type, color, and location of insets and borders.
 - 11. Type, color, and location of edge, transition, and other accessory strips.
 - 12. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.

- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- E. Qualification Data: For Installer, must be approved by the carpet manufacturer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.
- G. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.
- H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the carpet manufacturer.
- B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - 1. Review delivery, storage, and handling procedures.
 - 2. Review ambient conditions and ventilation procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

- A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
- B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.7 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Products: as shown on the Room Finish Schedule.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - 1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:
 - a. Total VOCs: 10.00 mg/sq. m x h.
 - b. Formaldehyde: 0.05 mg/sq. m x h.
 - c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.

- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.
- H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:

1. Prime coats which may be applied in shop under other sections.
2. Prime painting unprimed surfaces to be painted under this Section.
3. Painting items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
4. Painting ferrous metal (except stainless steel) exposed to view.
5. Painting galvanized ferrous metals exposed to view.
6. Painting interior concrete block exposed to view.
7. Painting gypsum drywall exposed to view.
8. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
9. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
10. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
11. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
12. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
13. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

1.2 RELATED WORK:

A. Activity Hazard Analysis: Section 01 35 26, SAFETY REQUIREMENTS.

- C. Lead Paint Removal: Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
- E. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS; Division 10 - SPECIALTIES; Division 11 - EQUIPMENT; Division 12 - FURNISHINGS
- F. Prefinished flush doors with transparent finishes: Section 08 14 00, WOOD DOORS.
- G. Type of Finish, Color, and Gloss Level of Finish Coat: Room Finish Schedule.
- J. Asphalt and concrete pavement marking: Section 32 17 23, PAVEMENT MARKINGS.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Painter qualifications.
- D. Manufacturer's Literature and Data:
 - 1. Before work is started, or sample panels are prepared, submit manufacturer's literature and technical data, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one (1) list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- E. Sample Panels:
 - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
 - 2. Panels to Show Color: Composition board, 100 x 250 mm (4 x 10 inch).
 - 3. Panel to Show Transparent Finishes: Wood of same species and grain pattern as wood approved for use, 100 x 250 mm (4 x 10 inch face) minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 x 50 mm (2 x 2 inch) minimum or actual wood member to show complete finish.
 - 4. Attach labels to panel stating the following:

- a. Federal Specification Number or manufacturers name and product number of paints used.
- b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- c. Product type and color.
- d. Name of project.
- 5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.
- F. Sample of identity markers if used.
- G. Manufacturers' Certificates indicating compliance with specified requirements:
 - 1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
 - 2. High temperature aluminum paint.
 - 3. Epoxy coating.
 - 4. Intumescent clear coating or fire retardant paint.
 - 5. Plastic floor coating.

1.4 DELIVERY AND STORAGE:

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
 - 1. Name of manufacturer.
 - 2. Product type.
 - 3. Batch number.
 - 4. Instructions for use.
 - 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
 - 1. Federal Specification Number, where applicable, and name of material.
 - 2. Surface upon which material is to be applied.
 - 3. Specify Coat Types: Prime; body; finish; etc.
- C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 7 and 30 degrees C (45 and 85 degrees F).

1.5 QUALITY ASSURANCE:

- A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that

key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.

- B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

1.7 REGULATORY REQUIREMENTS:

- A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
 2. Lead-Base Paint:
 - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
 - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
 - c. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.
 3. Asbestos: Provide materials that do not contain asbestos.
 4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
 5. Human Carcinogens: Provide materials that do not contain any of the ACGIH-BKLT and ACGIH-DOC confirmed or suspected human carcinogens.
 6. Use high performance acrylic paints in place of alkyd paints.

1.8 SAFETY AND HEALTH

- A. Apply paint materials using safety methods and equipment in accordance with the following:
 - 1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS. The AHA is to include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.
- B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.
- C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:
 - 1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
 - 2. 29 CFR 1910.1000.
 - 3. ACHIH-BKLT and ACGIH-DOC, threshold limit values.

1.9 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
 - ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
 - ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. ASME International (ASME):
 - A13.1-07(R2013).....Scheme for the Identification of Piping Systems
- D. Code of Federal Regulation (CFR):
 - 40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating
- E. Commercial Item Description (CID):
 - A-A-1272A.....Plaster Gypsum (Spackling Compound)
- F. Federal Specifications (Fed Spec):
 - TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

- 1.....Aluminum Paint
- 4.....Interior/ Exterior Latex Block Filler
- 5.....Exterior Alkyd Wood Primer
- 7.....Exterior Oil Wood Primer
- 8.....Exterior Alkyd, Flat MPI Gloss Level 1
- 9.....Exterior Alkyd Enamel MPI Gloss Level 6
- 10.....Exterior Latex, Flat
- 11.....Exterior Latex, Semi-Gloss
- 18.....Organic Zinc Rich Primer
- 22.....Aluminum Paint, High Heat (up to 590° - 1100F)
- 27.....Exterior / Interior Alkyd Floor Enamel, Gloss
- 31.....Polyurethane, Moisture Cured, Clear Gloss
- 36.....Knot Sealer
- 43.....Interior Satin Latex, MPI Gloss Level 4
- 44.....Interior Low Sheen Latex, MPI Gloss Level 2
- 45.....Interior Primer Sealer
- 46.....Interior Enamel Undercoat
- 47.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
- 48.....Interior Alkyd, Gloss, MPI Gloss Level 6
- 50.....Interior Latex Primer Sealer
- 51.....Interior Alkyd, Eggshell, MPI Gloss Level 3
- 52.....Interior Latex, MPI Gloss Level 3
- 53.....Interior Latex, Flat, MPI Gloss Level 1
- 54.....Interior Latex, Semi-Gloss, MPI Gloss Level 5
- 59.....Interior/Exterior Alkyd Porch & Floor Enamel, Low
Gloss
- 60.....Interior/Exterior Latex Porch & Floor Paint, Low
Gloss
- 66.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC
Approved)
- 67.....Interior Latex Fire Retardant, Top-Coat (ULC
Approved)
- 68.....Interior/ Exterior Latex Porch & Floor Paint,
Gloss
- 71.....Polyurethane, Moisture Cured, Clear, Flat
- 77.....Epoxy Cold Cured, Gloss
- 79.....Marine Alkyd Metal Primer

- 90.....Interior Wood Stain, Semi-Transparent
- 91.....Wood Filler Paste
- 94.....Exterior Alkyd, Semi-Gloss
- 95.....Fast Drying Metal Primer
- 98.....High Build Epoxy Coating
- 101.....Epoxy Anti-Corrosive Metal Primer
- 108.....High Build Epoxy Coating, Low Gloss
- 114.....Interior Latex, Gloss
- 119.....Exterior Latex, High Gloss (acrylic)
- 134.....Galvanized Water Based Primer
- 135.....Non-Cementitious Galvanized Primer
- 138.....Interior High Performance Latex, MPI Gloss Level 2
- 139.....Interior High Performance Latex, MPI Gloss Level 3
- 140.....Interior High Performance Latex, MPI Gloss Level 4
- 141.....Interior High Performance Latex (SG) MPI Gloss
Level 5
- 163.....Exterior Water Based Semi-Gloss Light Industrial
Coating, MPI Gloss Level 5

G. Society for Protective Coatings (SSPC):

- SSPC SP 1-82(R2004).....Solvent Cleaning
- SSPC SP 2-82(R2004).....Hand Tool Cleaning
- SSPC SP 3-28(R2004).....Power Tool Cleaning
- SSPC SP 10/NACE No.2.....Near-White Blast Cleaning
- SSPC PA Guide 10.....Guide to Safety and Health Requirements

H. Maple Flooring Manufacturer's Association (MFMA):

I. U.S. National Archives and Records Administration (NARA):

- 29 CFR 1910.1000.....Air Contaminants

J. Underwriter's Laboratory (UL)

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Conform to the coating specifications and standards referenced in PART 3.
Submit manufacturer's technical data sheets for specified coatings and solvents.

2.2 PAINT PROPERTIES:

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.
- C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to recommended limits.
- E. VOC test method for paints and coatings is to be in accordance with 40 CFR 59 (EPA Method 24). Part 60, Appendix A with the exempt compounds' content determined by Method 303 (Determination of Exempt Compounds) in the South Coast Air Quality Management District's (SCAQMD) "Laboratory Methods of Analysis for Enforcement Samples" manual.

2.3 PLASTIC TAPE:

- A. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.
- B. Pressure sensitive adhesive back.

PART 3 - EXECUTION

3.1 JOB CONDITIONS:

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
 - 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
 - 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.
- B. Atmospheric and Surface Conditions:
 - 1. Do not apply coating when air or substrate conditions are:
 - a. Less than 3 degrees C (5 degrees F) above dew point.
 - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the COR and the product manufacturer. Under no circumstances are application conditions to exceed manufacturer recommendations.
 - c. When the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.
 - 2. Maintain interior temperatures until paint dries hard.
 - 3. Do no exterior painting when it is windy and dusty.

4. Do not paint in direct sunlight or on surfaces that the sun will warm.
5. Apply only on clean, dry and frost free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces only when allowed by manufacturer's printed instructions.
 - b. Concrete and masonry when permitted by manufacturer's recommendations, dampen surfaces to which water thinned acrylic and cementitious paints are applied with a fine mist of water on hot dry days to prevent excessive suction and to cool surface.
6. Varnishing:
 - a. Apply in clean areas and in still air.
 - b. Before varnishing vacuum and dust area.
 - c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 INSPECTION:

- A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 GENERAL WORKMANSHIP REQUIREMENTS:

- A. Application may be by brush or roller. Spray application only upon acceptance from the COR in writing.
- B. Furnish to the COR a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.
- C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and leave work in a clean condition.
- D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.
- E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

- F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.
- G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.
- H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.
- I. All suction spots or "hot spots" in plaster after the application of the first coat are to be touched up before applying the second coat.
- J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

3.4 SURFACE PREPARATION:

A. General:

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.

- b. Fiber-Cement Board: 12 percent.
 - c. Masonry (Clay and CMU's): 12 percent.
 - d. Wood: 15 percent.
 - e. Gypsum Board: 12 percent.
 - f. Plaster: 12 percent.
- B. Wood:
- 1. Sand to a smooth even surface and then dust off.
 - 2. Sand surfaces showing raised grain smooth between each coat.
 - 3. Wipe surface with a tack rag prior to applying finish.
 - 4. Surface painted with an opaque finish:
 - a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
 - b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
 - 5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
 - 6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
 - 7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
 - a. Thin filler in accordance with manufacturer's instructions for application.
 - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.
- C. Ferrous Metals:
- 1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
 - 2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). // Where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.//
 - 3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish

- with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
- a. Fill flat head countersunk screws used for permanent anchors.
 - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
 5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.
- F. Gypsum Plaster and Gypsum Board:
1. Remove efflorescence, loose and chalking plaster or finishing materials.
 2. Remove dust, dirt, and other deterrents to paint adhesion.
 3. Fill holes, cracks, and other depressions with CID-A-A-1272A finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

3.5 PAINT PREPARATION:

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two (2) component and two (2) part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.6 APPLICATION:

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.

- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.
- E. Apply by brush or roller. Spray application for new or existing occupied spaces only upon approval by acceptance from COR in writing.
 - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
 - 2. In new construction and in existing occupied spaces, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in "Building and Structural Work Field Painting"; "Work not Painted"; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.
- F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.7 PRIME PAINTING:

- A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rabbets for stop and face glazing of wood, and for face glazing of steel.
- E. Wood and Wood Particleboard:
 - 1. Use same kind of primer specified for exposed face surface.
 - a. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer except where MPI 90 (Interior Wood Stain, Semi-Transparent) is scheduled.
 - b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.

2. Apply two (2) coats of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
 3. Apply one (1) coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
 4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
 5. Apply MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved) to wood for fire retardant finish.
- F. Metals except boilers, incinerator stacks, and engine exhaust pipes:
1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer) MPI 95 (Fast Drying Metal Primer).
 2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer).
 3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
- G. Gypsum Board and Hardboard:
1. Surfaces scheduled to have MPI 10 (Exterior Latex, Flat), MPI 11 (Exterior Latex, Semi-Gloss) and MPI 119 (Exterior Latex, High Gloss (acrylic)) MPI 114 (Interior Latex, Gloss) finish:
 2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) in shower and bathrooms.
- H. Gypsum Plaster and Veneer Plaster:
1. Surfaces scheduled to receive vinyl coated fabric wall covering: Use MPI 45 (Interior Primer Sealer).
 2. MPI 45 (Interior Primer Sealer), except use MPI 50 (Interior Latex Primer Sealer) when an alkyd flat finish is specified.
 3. Surfaces scheduled to have MPI 10 (Exterior Latex, Flat) or MPI 11 (Exterior Latex, Semi-Gloss) respectively.
- K. Concrete Floors: MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss)

3.8 EXTERIOR FINISHES:

- A. Apply following finish coats where specified in the Room Finish Schedule.

B. Wood:

1. Do not apply finish coats on surfaces concealed after installation, top and bottom edges of wood doors and sash, or on edges of wood framed insect screens.
2. Two (2) coats of // MPI 10 Exterior Latex, Flat) on exposed surfaces, except where transparent finish is specified.
3. Two (2) coats of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss) for transparent finish.

C. Steel and Ferrous Metal:

1. Two (2) coats of MPI 8 (Exterior Alkyd, Flat) on exposed surfaces, except on surfaces over 94 degrees C (201 degrees F).
2. Use two (2) coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious), unless specified otherwise.

3.9 INTERIOR FINISHES:

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in the Room Finish Schedule.

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
 - a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) unless specified otherwise.
 - b. Two (2) coats of MPI 48 (Interior Alkyd Gloss) or MPI 51 (Interior Alkyd, Eggshell).
 - c. One (1) coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss) on exposed interior surfaces of alkyd-amine enamel prime finished windows.
 - e. Machinery: One (1) coat MPI 9 (Exterior Alkyd Enamel).
 - f. Asphalt Coated Metal: One (1) coat MPI 1 (Aluminum Paint).
 - g. Ferrous Metal over 94 degrees K (290 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One (1) coat MPI 22 (High Heat Resistant Coating.

C. Gypsum Board:

1. One (1) coat of MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) plus one (1) coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3).

2. Two (2) coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2).
3. One (1) coat of MPI 45 (Interior Primer Sealer) MPI 46 (Interior Enamel Undercoat) plus one (1) coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) or MPI 114 (Interior Latex, Gloss).
4. One (1) coat of MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) plus one (1) coat of MPI 48 (Interior Alkyd Gloss).

2. Sealers:

- a. MPI 31 (gloss) or MPI 71 (flat) thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.
- b. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
- c. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
- d. Sand as specified.

3. Paint Finish:

- a. One (1) coat of MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) plus one (1) coat of MPI 47 (Interior Alkyd, Semi-Gloss).
- b. One (1) coat MPI 66 (Interior Alkyd Fire retardant, Clear Top-Coat (UL Approved) or MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved), intumescent type, on exposed wood in attics with floors used for mechanical equipment
- c. One (1) coat of MPI 45 Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) plus one (1) coat of MPI 48 (Interior Alkyd Gloss).
- d. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell).

H. Concrete Floors: One (1) coat of MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss).

I. Miscellaneous:

1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
2. MPI 1 (Aluminum Paint): Two (2) coats of aluminum paint.
4. Interstitial floor markings: One (1) coat MPI 27 (Exterior/ Interior Alkyd Floor Enamel, Gloss)

3.10 REFINISHING EXISTING PAINTED SURFACES:

- A. Clean, patch and repair existing surfaces as specified under "Surface Preparation". No "telegraphing" of lines, ridges, flakes, etc., through

new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR's approval.

- B. Remove and reinstall items as specified under "General Workmanship Requirements".
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one (1) coat of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss).
- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.11 PAINT COLOR:

- A. Color and gloss of finish coats is specified in Room Finish Schedule
- B. For additional requirements regarding color see Articles, "REFINISHING EXISTING PAINTED SURFACE" and "MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE".
- C. Coat Colors:
 - 1. Color of priming coat: Lighter than body coat.
 - 2. Color of body coat: Lighter than finish coat.
 - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
 - 1. Paint to match color of casework where casework has a paint finish.
 - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.12 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE:

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted in Room Finish Schedule, paint as specified below.
- C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING
- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
- H. Color:
 - 1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
 - 2. Paint colors as specified on Room Finish Schedule except for following:
 - a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
 - b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
 - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
 - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.

- e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
- I. Apply paint systems on properly prepared and primed surface as follows:
- 1. Exterior Locations:
 - a. Apply two (2) coats of MPI 8 (Exterior Alkyd, Flat) to the following ferrous metal items:
Vent and exhaust pipes with temperatures under 94 degrees C (201 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
 - b. Apply two (2) coats of MPI 10 (Exterior Latex, Flat) to galvanized and zinc-copper alloy metal.
 - c. Apply one (1) coat of MPI 22 (High Heat Resistant Coating), 650 degrees C (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.
 - 2. Interior Locations:
 - a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) to following items:
 - 1) Metal under 94 degrees C (201 degrees F) of items such as bare piping, fittings, hangers and supports.
 - 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
 - 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
 - d. Apply two (2) coats of MPI 22 (High Heat Resistant Coating) to ferrous metal surface over 94 degrees K (290 degrees F) of following items:
 - 1) Garbage and trash incinerator.
 - 2) Exterior of boilers and ferrous metal in connection with boiler settings including supporting members, doors and door frames and fuel oil burning equipment.
 - 3) Steam line flanges, bare pipe, fittings, valves, hangers and supports over 94 degrees K (290 degrees F).
 - 4) Engine generator exhaust piping and muffler.
 - e. Paint electrical conduits containing cables rated 600 volts or more using two (2) coats of MPI 9 (Exterior Alkyd Enamel) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.

3. Other exposed locations:

- a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two (2) coats of MPI 1 (Aluminum Paint).
- b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of MPI 10 (Exterior Latex, Flat).

3.13 BUILDING AND STRUCTURAL WORK FIELD PAINTING:

- A. Painting and finishing of interior and exterior work except as specified here-in-after.
 1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Room Finish Schedule.
 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
 3. Painting of ferrous metal and galvanized metal.
 4. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space (except shingles).
 5. Identity painting and safety painting.
- B. Building and Structural Work not Painted:
 1. Prefinished items:
 - a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
 - b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
 2. Finished surfaces:
 - a. Hardware except ferrous metal.
 - b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
 - c. Signs, fixtures, and other similar items integrally finished.
 3. Concealed surfaces:
 - a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
 - b. Inside walls or other spaces behind access doors or panels.
 - c. Surfaces concealed behind permanently installed casework and equipment.

4. Moving and operating parts:
 - a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
 - b. Tracks for overhead or coiling doors, shutters, and grilles.
5. Labels:
 - a. Code required label, such as Underwriters Laboratories Inc., Intertek Testing Service or Factory Mutual Research Corporation.
 - b. Identification plates, instruction plates, performance rating, and nomenclature.
6. Galvanized metal:
 - a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
 - b. Gas Storage Racks.
 - c. Except where specifically specified to be painted.
7. Metal safety treads and nosings.
8. Gaskets.
9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
10. Face brick.
11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.
13. Ceilings, walls, columns in interstitial spaces.
14. Ceilings, walls, and columns in pipe basements.
15. Wood Shingles.

3.14 IDENTITY PAINTING SCHEDULE:

- A. Identify designated service in new buildings or projects with extensive remodeling in accordance with ASME A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels. For existing spaces where work is minor match existing.
 1. Legend may be identified using snap-on coil plastic markers or by paint stencil applications.
 2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12.2 M (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
 3. Locate Legends clearly visible from operating position.

4. Use arrow to indicate direction of flow using black stencil paint.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on construction documents where asterisk appears for High, Medium, and Low Pressure designations as follows:
 - a. High Pressure - 414 kPa (60 psig) and above.
 - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
 - c. Low Pressure - 103 kPa (14 psig) and below.
 - d. Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows: Follow design standards by the tribe and these shall supersede any other information.

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Blow-off		Green	White	Blow-off
Boiler Feedwater		Green	White	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Shop Compressed Air		Blue	White	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Green	White	H.P. _____*
High Pressure Condensate Return		Green	White	H.P. Ret _____*
Medium Pressure Steam		Green	White	M. P. Stm _____*
Medium Pressure Condensate Return		Green	White	M.P. Ret _____*
Low Pressure Steam		Green	White	L.P. Stm _____*
Low Pressure Condensate Return		Green	White	L.P. Ret _____*
High Temperature Water Supply		Green	White	H. Temp Wtr Sup
High Temperature Water Return		Green	White	H. Temp Wtr Ret
Hot Water Heating Supply		Green	White	H. W. Htg Sup
Hot Water Heating Return		Green	White	H. W. Htg Ret

Elder Services Improvements
C.I.P # 05-013

Gravity Condensate Return		Green	White	Gravity Cond Ret
Pumped Condensate Return		Green	White	Pumped Cond Ret
Vacuum Condensate Return		Green	White	Vac Cond Ret
Fuel Oil - Grade // //		Brown	White	Fuel Oil-Grade // //
(Diesel Fuel included under Fuel Oil)				
Boiler Water Sampling		Green	White	Sample
Chemical Feed		Green	White	Chem Feed
Continuous Blow-Down		Green	White	Cont. B D
Pumped Condensate		Green	White	Pump Cond
Pump Recirculating		Green	White	Pump-Recirc.
Vent Line		Green	White	Vent
Alkali		Orange	Black	Alk
Bleach		Orange	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Orange	Black	Acid Waste
Vent		Orange	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler	Red	Red	White	Auto Spr
Standpipe	Red	Red	White	Stand
Sprinkler	Red	Red	White	Drain

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6096 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 5000
- f. Conduits containing high voltage feeders over 600 volts:

B. Fire and Smoke Partitions:

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
3. Locate not more than 6096 mm (20 feet) on center on corridor sides of partitions, and with a least one (1) message per room on room side of partition.
4. Use semi-gloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:

1. Apply stenciled number and letters to correspond with grid numbering and lettering indicated on construction documents.
2. Paint numbers and letters 101 mm (4 inches) high, locate 45 mm (18 inches) below overhead structural slab.
3. Apply on four (4) sides of interior columns and on inside face only of exterior wall columns.
4. Color:
 - a. Use black on concrete columns.
 - b. Use white or contrasting color on steel columns.

3.15 PROTECTION CLEAN UP, AND TOUCH-UP:

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

09 91 13 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete.
 - 2. Steel.
 - 3. Galvanized metal.
 - 4. Aluminum (not anodized or otherwise coated).
 - 5. Plastic trim fabrications.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
 - 4. Division 09 painting Sections for special-use coatings.
 - 5. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
 - 6. Division 09 Section "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. Benjamin Moore & Co., Limited (Canada).
 - 3. Bennette Paint Mfg. Co., Inc.
 - 4. BLP Mobile Paint Manufacturing.
 - 5. California Paints.
 - 6. ChemRex.
 - 7. Cloverdale Paint.
 - 8. Color Wheel Paints & Coatings.
 - 9. Columbia Paint & Coatings.
 - 10. Coronado Paint.
 - 11. Davis Paint Company.
 - 12. Del Technical Coatings.
 - 13. Diamond Vogel Paints.
 - 14. Dunn-Edwards Corporation.
 - 15. Durant Paints Inc.
 - 16. Duron, Inc.
 - 17. Envirocoat Technologies Inc.
 - 18. Farrell-Calhoun.
 - 19. Flex Bon Paints.
 - 20. Frazee Paint.
 - 21. General Paint.
 - 22. Griggs Paint.
 - 23. Hallman Lindsay Quality Paints.
 - 24. Hirshfield's, Inc.
 - 25. ICI Devoe (Canada).
 - 26. ICI Paints.
 - 27. ICI Paints (Canada).
 - 28. Insl-x.
 - 29. Iowa Paint Manufacturing Company, Inc.
 - 30. Kelly-Moore Paints.

31. Kryton Canada Corporation.
32. Kwal-Howells Paint.
33. M.A.B. Paints.
34. McCormick Paints.
35. Miller Paint.
36. Mills Paint.
37. NCP Coatings.
38. Northern Paint.
39. PARA Paints.
40. Parker Paint Mfg. Co. Inc.
41. Porter Paints.
42. PPG Architectural Finishes, Inc.
43. Rodda Paint Co.
44. Sherwin-Williams Company (The).
45. Sico, Inc.
46. Sigma Coatings.
47. Smiland Paint Company.
48. Spectra-Tone.
49. Tamms Industries, Inc.
50. Tower Paint.
51. Vista Paint.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: as shown on the drawings

2.3 PRIMERS/SEALERS

- A. Alkali-Resistant Primer: MPI #3.
- B. Bonding Primer (Water Based): MPI #17.
- C. Bonding Primer (Solvent Based): MPI #69.

2.4 METAL PRIMERS

- A. Alkyd Anticorrosive Metal Primer: MPI #79.
- B. Quick-Drying Alkyd Metal Primer: MPI #76.

- C. Cementitious Galvanized-Metal Primer: MPI #26.
- D. Waterborne Galvanized-Metal Primer: MPI #134.
- E. Quick-Drying Primer for Aluminum: MPI #95.

2.5 EXTERIOR LATEX PAINTS

- A. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
- B. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).
- C. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

2.6 EXTERIOR ALKYD PAINTS

- A. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).
- B. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).
- C. Exterior Alkyd Enamel (Gloss): MPI #9 (Gloss Level 6).

2.7 QUICK-DRYING ENAMELS

- A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
- B. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).

2.8 ALUMINUM PAINT

- A. Aluminum Paint: MPI #1.

2.9 FLOOR COATINGS

- A. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
- B. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Plaster: 12 percent.
 - 3. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

- F. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Aluminum Substrates: Remove surface oxidation.
- I. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
- J. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
- K. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
- L. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- M. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- N. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.3 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of paint materials with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex System: MPI EXT 3.1A.
 - a. Prime Coat: Exterior latex matching topcoat.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex **flat**
- B. Concrete Substrates, Traffic Surfaces:
 - 1. Latex Floor Paint System: MPI EXT 3.2A.
 - a. Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
 - c. Topcoat: Interior/exterior latex floor and porch paint (low gloss).
- C. Steel Substrates:
 - 1. Quick-Drying Enamel System: MPI EXT 5.1A.
 - a. Prime Coat: Quick-drying alkyd metal primer.
 - b. Intermediate Coat: Quick-drying enamel matching topcoat.
 - c. Topcoat: Quick-drying enamel **semigloss**
 - 2. Aluminum Paint System: MPI EXT 5.1K.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Aluminum paint.
 - c. Topcoat: Aluminum paint.
- D. Galvanized-Metal Substrates:
 - 1. Latex System: MPI EXT 5.3A.

- a. Prime Coat: Cementitious galvanized-metal primer.
- b. Intermediate Coat: Exterior latex matching topcoat.
- c. Topcoat: Exterior latex **flat**.

E. Aluminum Substrates:

1. Latex System: MPI EXT 5.4H.

- a. Prime Coat: Quick-drying primer for aluminum.
- b. Intermediate Coat: Exterior latex matching topcoat.
- c. Topcoat: Exterior latex **flat**

F. Plastic Trim Fabrication Substrates:

1. Latex System: MPI EXT 6.8A.

- a. Prime Coat: Bonding primer **water based**
- b. Intermediate Coat: Exterior latex matching topcoat.
- c. Topcoat: Exterior latex **flat**

END OF SECTION 099113

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SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Public-use washroom accessories.
 - 2. Warm-air dryers.
 - 3. Underlavatory guards.
 - 4. Custodial accessories.
- B. Owner furnished, contractor installed material:
 - 1. Toilet tissue holders
 - 2. Paper towel dispensers
 - 3. Soap dispensers (mounting on mirror prohibited)
- C. Owner furnished material:
 - 1. Waste receptacles.
- D. Related Sections include the following:
 - 1. Division 08 Section "Mirrors" for frameless mirrors.
 - 2. Division 09 Section "Tiling" for ceramic toilet and bath accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated on Drawings.

- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.
- 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.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- 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. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
 - 5. General Accessory Manufacturing Co. (GAMCO).
 - 6. Approved Manufacturer.
- B. Grab Bar:
 - 1. Mounting: Flanges with concealed fasteners.
 - 2. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.
 - 3. Outside Diameter: 1-1/2 inches.
 - 4. Configuration and Length: As indicated on Drawings.
- C. Sanitary-Napkin Disposal Unit:
 - 1. Mounting: Recessed.
 - 2. Door or Cover: Self-closing disposal-opening cover and hinged face panel with tumbler lockset.
 - 3. Receptacle: Removable.
 - 4. Material and Finish: Stainless steel, No. 4 finish (satin).
- D. Seat-Cover Dispenser:
 - 1. Mounting: Recessed.
 - 2. Minimum Capacity: 250 seat covers.
 - 3. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
 - 4. Lockset: Tumbler type.
- E. Mirror Unit:
 - 1. Frame: Stainless-steel angle, 0.05 inch thick.
 - a. Corners: Welded and ground smooth.

2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
3. Size: As indicated on Drawings.

2.3 WARM-AIR DRYERS

- 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. A & J Washroom Accessories, Inc.
 2. American Dryer, Inc.
 3. American Specialties, Inc.
 4. Bobrick Washroom Equipment, Inc.
 5. Bradley Corporation.
 6. Excel Dryer Corporation.
 7. General Accessory Manufacturing Co. (GAMCO).
 8. World Dryer Corporation.
 9. Approved Manufacturer.
- B. Warm-Air Dryer:
 1. Mounting: Semirecessed.
 2. Operation: Electronic-sensor activated with timed power cut-off switch.
 - a. Operation Time: 30 to 40 seconds.
 3. Cover Material and Finish: Stainless steel, No. 4 finish (satin).
 4. Electrical Requirements: 115 V, 20 A, 2300 W.

2.4 UNDERLAVATORY GUARDS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 1. Plumberex Specialty Products, Inc.
 2. TCI Products.
 3. Truebro, Inc.
 4. Approved Manufacturer.

D. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded-plastic, white.

2.5 CUSTODIAL ACCESSORIES

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. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).
6. Approved Manufacturer.

B. Utility Shelf:

1. Description: With exposed edges turned down not less than 1/2 inch and supported by two triangular brackets welded to shelf underside.
2. Size: 16 inches long by 6 inches deep.
3. Material and Finish: Not less than nominal 0.05-inch- thick stainless steel, No. 4 finish (satin).

C. Mop and Broom Holder:

1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
2. Length: 36 inches.
3. Hooks: Three.
4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
 - b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.6 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 300 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

SECTION 104413 – FIRE EXTINGUISHERS AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Portable fire extinguishers.
- B. Fire-protection cabinets for portable fire extinguishers.

1.2 RELATED SECTIONS

- A. Section 09910: Finish paint for fire extinguisher cabinets.
 - 1. Clarification: Fire extinguisher cabinets are to be supplied with factory-applied painted finish. After installation, they receive one site-applied coat of finish paint.

1.3 SUBMITTALS – ACTION

- A. Comply with requirements of Section 01330.
- B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- C. Samples: Available lettering styles and sizes for identification signs.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Locations of portable fire extinguishers shown on plans are preliminary. Coordinate final locations and quantities with Fire Marshall. Coordinate final locations of fire extinguisher cabinets in public areas with Architect.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

- D. Handicapped Accessibility Standard: In addition to requirements of authorities having jurisdiction, provide Work conforming to Americans with Disabilities Act (ADA) and Accessibility Guidelines for Buildings and Facilities (ADAAG).

1.5 DELIVERY, STORAGE, HANDLING

- A. Comply with requirements of Section 01600.

1.6 COORDINATION

- A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers are accommodated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one manufacturer in each of the following categories:
 - 1. Portable Fire Extinguishers:
 - a. Ansul Incorporated.
 - b. J.L. Industries, Inc.
 - c. Kidde: Walter Kidde, The Fire Extinguisher Co.
 - d. Larsen's Manufacturing Company.
 - e. Modern Metal Products; Div. of Technico.
 - f. Potter-Roemer; Div. of Smith Industries, Inc.
 - g. Watrous; Div. of American Specialties, Inc.
 - 2. Fire-Protection Cabinets:
 - a. J.L. Industries, Inc.
 - b. Larsen's Manufacturing Company.
 - c. Modern Metal Products; Div. of Technico.
 - d. Potter-Roemer; Div. of Smith Industries, Inc.
 - e. Watrous; Div. of American Specialties, Inc.

2.2 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.
 - 1. Provide Class K portable fire extinguishers in commercial kitchen areas.
 - 2. Provide multipurpose dry-chemical type in all other locations.
- B. Multipurpose Dry-Chemical Type: UL-rated 2-A:10:B:C, 10-lb nominal capacity, in enameled-steel container.
- C. Class K Type: Wet chemical type in stainless steel container. Provide capacity as required by Fire Marshal.

2.3 FIRE-PROTECTION CABINETS

- A. Cabinet Construction: Provide manufacturer's standard box [tub], with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
 - 1. Cabinet Mounting: Semi-recessed.
 - 2. Door Material: Steel with factory-applied enamel finish in standard color selected by Architect.
 - 3. Door Style: Vertical duo glazed.
 - 4. Cabinet Interior Finish: Baked-enamel finish consisting of prime coat and thermosetting topcoat.
 - 5. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - a. Latching: Exposed door pull and friction latch.
 - b. Hinges: Concealed or continuous-type hinge permitting door to open 180 degrees.
- B. Cabinet Sizes: Provide sizes to accommodate required portable fire extinguishers, but not less than 5" diameter by 22" tall extinguishers.
- C. Fire-Rated Cabinets: Where fire extinguisher cabinets are required in rated walls, provide cabinets listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.
 - 1. Construct fire-rated cabinets with double walls fabricated from 0.0478-inch thick, cold-rolled steel sheet lined with minimum 5/8-inch thick, fire-barrier material.
 - 2. Provide factory-drilled mounting holes.

2.4 ACCESSORIES

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.
 - 1. Provide brackets for extinguishers not located in cabinets.
- B. Identification: Comply with Fire Marshal requirements.
 - 1. Cabinets: Match cabinets in existing building.
 - 2. Bracket-Mounted Fire Extinguishers: Red letter decals or plastic sign applied to wall surface.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets are to be installed.
- B. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged units.

3.2 INSTALLATION

- A. Comply with requirements of Section 01700.
- B. Install in locations indicated at heights conforming to ADAAG.
- C. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
- D. Fasten cabinets to structure, square and plumb.
- E. Fasten mounting brackets to structure square and plumb. Locate identification signs where acceptable to Fire Marshal.
- F. Cabinet Locations:
 - 1. Guest room corridors and all other public areas.
 - 2. Administrative offices.
 - 3. Stage and dressing room areas.
- G. Bracket-Mounted Locations:
 - 1. Food preparation areas.

2. Laundry service areas.
3. Loading docks, mechanical and electrical rooms, other utility areas.

3.3 ADJUSTING

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.

END OF SECTION

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1 SECTION 220513

2 COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

3 PART 1 - GENERAL

4 1.1 SUMMARY

- 5 A. Section includes general requirements for single-phase and polyphase, general-purpose,
6 horizontal, small and medium, squirrel-cage induction motors for use on ac power
7 systems up to 600 V and installed at equipment manufacturer's factory or shipped
8 separately by equipment manufacturer for field installation.

9 1.2 COORDINATION

- 10 A. Coordinate features of motors, installed units, and accessory devices to be compatible
11 with the following:
- 12 1. Motor controllers.
 - 13 2. Torque, speed, and horsepower requirements of the load.
 - 14 3. Ratings and characteristics of supply circuit and required control sequence.
 - 15 4. Ambient and environmental conditions of installation location.

16 PART 2 - PRODUCTS

17 2.1 GENERAL MOTOR REQUIREMENTS

- 18 A. Comply with NEMA MG 1 unless otherwise indicated.

19 2.2 MOTOR CHARACTERISTICS

- 20 A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet
21 above sea level.
- 22 B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate
23 connected loads at designated speeds, at installed altitude and environment, with
24 indicated operating sequence, and without exceeding nameplate ratings or considering
25 service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F
- I. Code Letter Designation:
 - 1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 220517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

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.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
 2. CALPICO, Inc.
 3. Metraflex Company (The).
 4. Or approved equal.

1 B. Description: Modular sealing-element unit, designed for field assembly, for filling
2 annular space between piping and sleeve.

3 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe.
4 Include type and number required for pipe material and size of pipe.

5 2. Pressure Plates: Stainless steel.

6 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of
7 length required to secure pressure plates to sealing elements.

8 2.3 GROUT

9 A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting,
10 dry, hydraulic-cement grout.

11 B. Characteristics: Nonshrink; recommended for interior and exterior applications.

12 C. Design Mix: 5000-psi, 28-day compressive strength.

13 D. Packaging: Premixed and factory packaged.

14 PART 3 - EXECUTION

15 3.1 SLEEVE INSTALLATION

16 A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and
17 walls.

18 B. For sleeves that will have sleeve-seal system installed, select sleeves of size large
19 enough to provide 1-inch annular clear space between piping and concrete slabs and
20 walls.

21 1. Sleeves are not required for core-drilled holes.

22 C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs
23 and walls are constructed.

24 1. Cut sleeves to length for mounting flush with both surfaces.

25 a. Exception: Extend sleeves installed in floors of mechanical equipment areas
26 or other wet areas 2 inches above finished floor level.

27 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-
28 seal system.

29 D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6 Galvanized-steel-pipe sleeves.
 2. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe 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.

END OF SECTION

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SECTION 220518

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.

- c. Insulated Piping: One-piece, stamped-steel type.
- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
- h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
- j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
- k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

1 SECTION 220523

2 VALVES FOR PLUMBING PIPING

3 PART 1 - GENERAL

4 1.1 SUMMARY

5 A. Section Includes:

- 6 1. Brass ball valves.

7 1.2 SUBMITTALS

8 A. Product Data: For each type of valve.

- 9 1. Certification that products comply with NSF 61 Annex G.

10 PART 2 - PRODUCTS

11 2.1 GENERAL REQUIREMENTS FOR VALVES

12 A. Source Limitations for Valves: Obtain each type of valve from single source from
13 single manufacturer.

14 B. ASME Compliance:

- 15 1. ASME B1.20.1 for threads for threaded end valves.
16 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design
17 criteria.
18 3. ASME B16.18 for solder-joint connections.

19 C. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

20 D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system
21 pressures and temperatures.

22 E. Valve Sizes: Same as upstream piping unless otherwise indicated.

23 F. Valves in Insulated Piping:

- 24 1. Include 2-inch stem extensions.

2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Two-Piece, Brass Ball Valves with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Crane; Crane Energy Flow Solutions.
 - c. NIBCO INC.
 - d. Or approved equal.
2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

1 3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

2 A. If valves with specified CWP ratings are unavailable, the same types of valves with
3 higher CWP ratings may be substituted.

4 B. Select valves with the following end connections:

- 5 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint
6 valve-end option is indicated in valve schedules below.

7 3.3 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

8 A. Pipe NPS 2 and Smaller:

- 9 1. Brass Valves: May be provided with solder-joint ends instead of threaded ends.
10 2. Two-piece, brass ball valves with full, regular port and brass trim.
11 3. Two-piece, bronze ball valves with full, regular port and bronze or brass trim.

12 3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

13 A. Pipe NPS 2 and Smaller:

- 14 1. Brass Valves: May be provided with solder-joint ends instead of threaded ends.
15 2. Two-piece, brass ball valves with full, regular port and brass trim.

16 3.5 ADJUSTING

17 A. Adjust or replace valve packing after piping systems have been tested and put into
18 service but before final adjusting and balancing. Replace valves if persistent leaking
19 occurs.

20 END OF SECTION

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1 SECTION 220529

2 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

3 PART 1 - GENERAL

4 1.1 SUMMARY

5 A. Section Includes:

- 6 1. Metal pipe hangers and supports.
7 2. Thermal-hanger shield inserts.
8 3. Fastener systems.
9 4. Pipe positioning systems.

10 1.2 PERFORMANCE REQUIREMENTS

11 A. Delegated Design: Design trapeze pipe hangers and equipment supports, including
12 comprehensive engineering analysis by a qualified professional engineer, using
13 performance requirements and design criteria indicated.

14 B. Structural Performance: Hangers and supports for plumbing piping and equipment shall
15 withstand the effects of gravity loads and stresses within limits and under conditions
16 indicated according to ASCE/SEI 7.

- 17 1. Design supports for multiple pipes capable of supporting combined weight of
18 supported systems, system contents, and test water.
19 2. Design equipment supports capable of supporting combined operating weight of
20 supported equipment and connected systems and components.

21 1.3 SUBMITTALS

22 A. Product Data: For each type of product indicated.

23 PART 2 - PRODUCTS

24 2.1 METAL PIPE HANGERS AND SUPPORTS

25 A. Carbon-Steel Pipe Hangers and Supports:

- 26 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
27 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.

2.2 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 MISCELLANEOUS MATERIALS

- A. 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. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

- 1 B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- 2 C. Fastener System Installation:
- 3 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs
4 less than 4 inches thick in concrete after concrete is placed and completely cured.
5 Use operators that are licensed by powder-actuated tool manufacturer. Install
6 fasteners according to powder-actuated tool manufacturer's operating manual.
- 7 2. Install mechanical-expansion anchors in concrete after concrete is placed and
8 completely cured. Install fasteners according to manufacturer's written
9 instructions.
- 10 D. Pipe Positioning-System Installation: Install support devices to make rigid supply and
11 waste piping connections to each plumbing fixture.
- 12 E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods,
13 nuts, washers, and other accessories.
- 14 F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- 15 G. Install hangers and supports to allow controlled thermal and seismic movement of
16 piping systems, to permit freedom of movement between pipe anchors, and to facilitate
17 action of expansion joints, expansion loops, expansion bends, and similar units.
- 18 H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- 19 I. Install building attachments within concrete slabs or attach to structural steel. Install
20 additional attachments at concentrated loads, including valves, flanges, and strainers,
21 NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts
22 before concrete is placed; fasten inserts to forms and install reinforcing bars through
23 openings at top of inserts.
- 24 J. Load Distribution: Install hangers and supports so that piping live and dead loads and
25 stresses from movement will not be transmitted to connected equipment.
- 26 K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not
27 exceed maximum pipe deflections allowed by ASME B31.9 for building services
28 piping.
- 29 L. Insulated Piping:
- 30 1. Attach clamps and spacers to piping.
- 31 a. Piping Operating above Ambient Air Temperature: Clamp may project
32 through insulation.
- 33 b. Piping Operating below Ambient Air Temperature: Use thermal-hanger
34 shield insert with clamp sized to match OD of insert.

- c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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.

3.3 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 a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.4 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.

- 1 C. Use hangers and supports with galvanized metallic coatings for piping and equipment
2 that will not have field-applied finish.
- 3 D. Use nonmetallic coatings on attachments for electrolytic protection where attachments
4 are in direct contact with copper tubing.
- 5 E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and
6 attachments for general service applications.
- 7 F. Use padded hangers for piping that is subject to scratching.
- 8 G. Use thermal-hanger shield inserts for insulated piping and tubing.
- 9 H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as
10 specified in piping system Sections, install the following types:
- 11 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated
12 or insulated, stationary pipes NPS 1/2 to NPS 30.
- 13 I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping
14 system Sections, install the following types:
- 15 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4
16 to NPS 24.
- 17 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers
18 NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- 19 J. Building Attachments: Unless otherwise indicated and except as specified in piping
20 system Sections, install the following types:
- 21 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to
22 suspend pipe hangers from concrete ceiling.
- 23 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-
24 joist construction, to attach to top flange of structural shape.
- 25 K. Saddles and Shields: Unless otherwise indicated and except as specified in piping
26 system Sections, install the following types:
- 27 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids
28 with insulation that matches adjoining insulation.
- 29 2. Protection Shields (MSS Type 40): Of length recommended in writing by
30 manufacturer to prevent crushing insulation.
- 31 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- 32 L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building
33 attachments where required in concrete construction.

- 1 M. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply
- 2 and waste piping for plumbing fixtures.

3 END OF SECTION

1 SECTION 220553

2 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

3 PART 1 - GENERAL

4 1.1 SUMMARY

5 A. Section Includes:

- 6 1. Equipment labels.
7 2. Pipe labels.

8 1.2 SUBMITTALS

9 A. Product Data: For each type of product indicated.

10 PART 2 - PRODUCTS

11 2.1 EQUIPMENT LABELS

12 A. Metal Labels for Equipment:

- 13 1. Manufacturers: Subject to compliance with requirements, provide products by one
14 of the following:
- 15 a. Brady Corporation.
 - 16 b. Kolbi Pipe Marker Co.
 - 17 c. Marking Services, Inc.
 - 18 d. Or approved equal.
- 19 2. Material and Thickness: anodized aluminum, 0.032-inch minimum thickness, and
20 having predrilled or stamped holes for attachment hardware.
- 21 3. Letter Color: Black.
- 22 4. Background Color: White.
- 23 5. Minimum Label Size: Length and width vary for required label content, but not
24 less than 2-1/2 by 3/4 inch.
- 25 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than
26 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately
27 larger lettering for greater viewing distances. Include secondary lettering two-
28 thirds to three-quarters the size of principal lettering.
- 29 7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Brady Corporation.
- b. Kolbi Pipe Marker Co.
- c. Marking Services, Inc.
- d. Or approved equal.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

3. Letter Color: Black.

4. Background Color: White.

5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

7. 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-quarters the size of principal lettering.

8. Fasteners: Stainless-steel rivets or self-tapping screws.

9. 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), and 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) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Kolbi Pipe Marker Co.
3. Marking Services Inc.
4. Or approved equal.

- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include 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 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.2 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: 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 and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

- 1 B. Pipe Label Color Schedule:
- 2 1. Domestic Water Piping
- 3 a. Background: Safety green.
- 4 b. Letter Colors: White.
- 5 2. Sanitary Waste and Storm Drainage Piping:
- 6 a. Background Color: Safety white.
- 7 b. Letter Color: Black.
- 8 END OF SECTION

1 SECTION 220719
2 PLUMBING PIPING INSULATION

3 PART 1 - GENERAL

4 1.1 SUMMARY

5 A. Section includes insulating the following plumbing piping services:

- 6 1. Domestic hot-water piping.
7 2. Domestic recirculating hot-water piping.
8 3. Sanitary waste piping exposed to freezing conditions.
9 4. Storm-water piping exposed to freezing conditions.
10 5. Roof drains and rainwater leaders.
11 6. Supplies and drains for handicap-accessible lavatories and sinks.

12 B. Related Sections:

- 13 1. Section 220716 "Plumbing Equipment Insulation."

14 1.2 SUBMITTALS

15 A. Product Data: For each type of product indicated.

16 1.3 INFORMATIONAL SUBMITTALS

17 A. Field quality-control reports.

18 1.4 QUALITY ASSURANCE

19 A. Surface-Burning Characteristics: For insulation and related materials, as determined by
20 testing identical products according to ASTM E 84 by a testing agency acceptable to
21 authorities having jurisdiction. Factory label insulation and jacket materials and
22 adhesive, mastic, tapes, and cement material containers, with appropriate markings of
23 applicable testing agency.

- 24 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-
25 developed index of 50 or less.
26 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-
27 developed index of 150 or less.

28 B. Comply with the following applicable standards and other requirements specified for
29 miscellaneous components:

- 30 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Manson Insulation Inc.
 - d. Or approved equal.
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Or approved equal.
2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Or approved equal.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Foster Brand; H. B. Fuller Construction Products.
 - b. Or approved equal.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.

2.5 SEALANTS

- A. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Childers Brand; H. B. Fuller Construction Products.
- b. Eagle Bridges - Marathon Industries.
- c. Mon-Eco Industries, Inc.
- d. Or approved equal.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Permanently flexible, elastomeric sealant.

4. Service Temperature Range: Minus 100 to plus 300 deg F.

5. Color: White or gray.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Childers Brand; H. B. Fuller Construction Products.
- b. Eagle Bridges - Marathon Industries.
- c. Foster Brand; H. B. Fuller Construction Products.
- d. Or approved equal.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: Aluminum.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: Minus 40 to plus 250 deg F.

4. Color: White.

5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

- 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Foster Brand; H. B. Fuller Construction Products.
- b. Or approved equal.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Avery Dennison Corporation, Specialty Tapes Division.
- b. Ideal Tape Co., Inc., an American Biltrite Company.
- c. Knauf Insulation.
- d. Or approved equal.

- 2. Width: 3 inches.
- 3. Thickness: 11.5 mils.
- 4. Adhesion: 90 ounces force/inch in width.
- 5. Elongation: 2 percent.
- 6. Tensile Strength: 40 lbf/inch in width.
- 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.10 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1 a. ITW Insulation Systems; Illinois Tool Works, Inc.
- 2 b. Or approved equal.
- 3 B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or
- 4 Monel.

5 PART 3 - EXECUTION

6 3.1 PREPARATION

- 7 A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials
- 8 that will adversely affect insulation application.
- 9 B. Coordinate insulation installation with the trade installing heat tracing. Comply with
- 10 requirements for heat tracing that apply to insulation.
- 11 C. Mix insulating cements with clean potable water; if insulating cements are to be in
- 12 contact with stainless-steel surfaces, use demineralized water.

13 3.2 GENERAL INSTALLATION REQUIREMENTS

- 14 A. Install insulation materials, accessories, and finishes with smooth, straight, and even
- 15 surfaces; free of voids throughout the length of piping including fittings, valves, and
- 16 specialties.
- 17 B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses
- 18 required for each item of pipe system as specified in insulation system schedules.
- 19 C. Install accessories compatible with insulation materials and suitable for the service.
- 20 Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in
- 21 either wet or dry state.
- 22 D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- 23 E. Install multiple layers of insulation with longitudinal and end seams staggered.
- 24 F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and
- 25 specialties.
- 26 G. Keep insulation materials dry during application and finishing.
- 27 H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints
- 28 with adhesive recommended by insulation material manufacturer.
- 29 I. Install insulation with least number of joints practical.

- 1 J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at
2 hangers, supports, anchors, and other projections with vapor-barrier mastic.
- 3 1. Install insulation continuously through hangers and around anchor attachments.
4 2. For insulation application where vapor barriers are indicated, extend insulation on
5 anchor legs from point of attachment to supported item to point of attachment to
6 structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
7 3. Install insert materials and install insulation to tightly join the insert. Seal
8 insulation to insulation inserts with adhesive or sealing compound recommended
9 by insulation material manufacturer.
10 4. Cover inserts with jacket material matching adjacent pipe insulation. Install
11 shields over jacket, arranged to protect jacket from tear or puncture by hanger,
12 support, and shield.
- 13 K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate
14 and wet and dry film thicknesses.
- 15 L. Install insulation with factory-applied jackets as follows:
- 16 1. Draw jacket tight and smooth.
17 2. Cover circumferential joints with 3-inch- wide strips, of same material as
18 insulation jacket. Secure strips with adhesive and outward clinching staples along
19 both edges of strip, spaced 4 inches o.c.
20 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with
21 longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing
22 lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
- 23 a. For below-ambient services, apply vapor-barrier mastic over staples.
- 24 4. Cover joints and seams with tape, according to insulation material manufacturer's
25 written instructions, to maintain vapor seal.
26 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and
27 joints and at ends adjacent to pipe flanges and fittings.
- 28 M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its
29 nominal thickness.
- 30 N. Finish installation with systems at operating conditions. Repair joint separations and
31 cracking due to thermal movement.
- 32 O. Repair damaged insulation facings by applying same facing material over damaged
33 areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal
34 patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with

insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.6 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.7 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Stormwater and Overflow: Insulation shall be one of the following:
 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:
 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:
 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- E. Sanitary Waste Piping Where Heat Tracing Is Installed: Mineral-fiber, preformed pipe insulation, Type I, 1-1/2 inches thick.

END OF SECTION

1 SECTION 221116

2 DOMESTIC WATER PIPING

3 PART 1 - GENERAL

4 1.1 SUMMARY

5 A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and
6 fittings inside buildings.

7 B. Related Requirements:

- 8 1. Section 221113 "Facility Water Distribution Piping" for water-service piping and
9 water meters outside the building from source to the point where water-service
10 piping enters the building.

11 1.2 SUBMITTALS

12 A. Product Data: For transition fittings and dielectric fittings.

13 1.3 INFORMATIONAL SUBMITTALS

14 A. System purging and disinfecting activities report.

15 B. Field quality-control reports.

16 PART 2 - PRODUCTS

17 2.1 PIPING MATERIALS

18 A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube,
19 fitting materials, and joining methods for specific services, service locations, and pipe
20 sizes.

21 B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G.
22 Plastic piping components shall be marked with "NSF-pw."

23 2.2 COPPER TUBE AND FITTINGS

24 A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

- 1 B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- 2 C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- 3 D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure
- 4 fittings.
- 5 E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- 6 F. Copper Unions:
 - 7 1. MSS SP-123.
 - 8 2. Cast-copper-alloy, hexagonal-stock body.
 - 9 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 10 4. Solder-joint or threaded ends.
- 11 G. Copper Pressure-Seal-Joint Fittings:
 - 12 1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-
 - 13 ring seal in each end.
 - 14 2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with
 - 15 EPDM-rubber, O-ring seal in each end.
- 16 H. Copper Push-on-Joint Fittings:
 - 17 1. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting
 - 18 complying with ASME B 16.22.
 - 19 2. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-
 - 20 joint ends.

21 2.3 PIPING JOINING MATERIALS

- 22 A. Pipe-Flange Gasket Materials:
 - 23 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21,
 - 24 nonmetallic and asbestos free unless otherwise indicated.
 - 25 2. Full-face or ring type unless otherwise indicated.
- 26 B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise
- 27 indicated.
- 28 C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- 29 D. Flux: ASTM B 813, water flushable.
- 30 E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for
- 31 general-duty brazing unless otherwise indicated.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Capitol Manufacturing Company.
- b. Central Plastics Company.
- c. Watts; a Watts Water Technologies company.
- d. Or approved equal.

2. Standard: ASSE 1079.

3. Pressure Rating: 150 psig.

4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Grinnell Mechanical Products.
- b. Precision Plumbing Products.
- c. Or approved equal.

2. Standard: IAPMO PS 66.

3. Electroplated steel nipple complying with ASTM F 1545.

4. Pressure Rating and Temperature: 300 psig at 225 deg F.

5. End Connections: Male threaded or grooved.

6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and

1 calculate friction loss, expansion, and other design considerations. Install piping as
2 indicated unless deviations to layout are approved on coordination drawings.

3 B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

4 C. Install ductile-iron piping under building slab with restrained joints according to
5 AWWA C600 and AWWA M41.

6 D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with
7 valve inside the building at each domestic water-service entrance. Comply with
8 requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing
9 Piping" and with requirements for drain valves and strainers in Section 221119
10 "Domestic Water Piping Specialties."

11 E. Install shutoff valve immediately upstream of each dielectric fitting.

12 F. Install domestic water piping level with 0.25 percent slope downward toward drain and
13 plumb.

14 G. Install piping concealed from view and protected from physical contact by building
15 occupants unless otherwise indicated and except in equipment rooms and service areas.

16 H. Install piping indicated to be exposed and piping in equipment rooms and service areas
17 at right angles or parallel to building walls. Diagonal runs are prohibited unless
18 specifically indicated otherwise.

19 I. Install piping above accessible ceilings to allow sufficient space for ceiling panel
20 removal, and coordinate with other services occupying that space.

21 J. Install piping to permit valve servicing.

22 K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or
23 higher than the system pressure rating used in applications below unless otherwise
24 indicated.

25 L. Install piping free of sags and bends.

26 M. Install fittings for changes in direction and branch connections.

27 N. Install unions in copper tubing at final connection to each piece of equipment, machine,
28 and specialty.

29 O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with
30 requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for
31 Plumbing Piping."

1 P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with
2 requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for
3 Plumbing Piping."

4 Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with
5 requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing
6 Piping."

7 3.3 JOINT CONSTRUCTION

8 A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

9 B. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook,"
10 "Brazed Joints" chapter.

11 C. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of
12 tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube
13 Handbook."

14 D. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings
15 with tools recommended by fitting manufacturer.

16 E. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with
17 materials of both piping systems.

18 3.4 TRANSITION FITTING INSTALLATION

19 A. Install transition couplings at joints of dissimilar piping.

20 B. Transition Fittings in Underground Domestic Water Piping:

21 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.

22 3.5 DIELECTRIC FITTING INSTALLATION

23 A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

24 B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

25 C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.

26 3.6 HANGER AND SUPPORT INSTALLATION

27 A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration
28 and Seismic Controls for Plumbing Piping and Equipment."

- 1 B. Comply with requirements for pipe hanger, support products, and installation in
2 Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- 3 C. Support vertical piping and tubing at base and at each floor.
- 4 D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8
5 inch.
- 6 E. Install hangers for copper tubing with the following maximum horizontal spacing and
7 minimum rod diameters:
 - 8 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 9 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
- 10 F. Install supports for vertical copper tubing every 10 feet.
- 11 G. Install hangers for steel piping with the following maximum horizontal spacing and
12 minimum rod diameters:
 - 13 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.

14 3.7 IDENTIFICATION

- 15 A. Identify system components. Comply with requirements for identification materials and
16 installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- 17 B. Label pressure piping with system operating pressure.

18 3.8 FIELD QUALITY CONTROL

- 19 A. Perform the following tests and inspections:
 - 20 1. Piping Inspections:
 - 21 a. Do not enclose, cover, or put piping into operation until it has been
22 inspected and approved by authorities having jurisdiction.
 - 23 b. During installation, notify authorities having jurisdiction at least one day
24 before inspection must be made. Perform tests specified below in presence
25 of authorities having jurisdiction:
 - 26 1) Roughing-in Inspection: Arrange for inspection of piping before
27 concealing or closing in after roughing in and before setting fixtures.
 - 28 2) Final Inspection: Arrange for authorities having jurisdiction to
29 observe tests specified in "Piping Tests" Subparagraph below and to
30 ensure compliance with requirements.

- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

- 1. Close drain valves, hydrants, and hose bibbs.
- 2. Open shutoff valves to fully open position.
- 3. Open throttling valves to proper setting.
- 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
- 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
- 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L; copper push-on-joint fittings; and push-on joints.

END OF SECTION

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SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing valves.
2. Wall hydrants.
3. Drain valves.
4. Water-hammer arresters.

B. Related Requirements:

1. Section 221116 "Domestic Water Piping" for water meters.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 BALANCING VALVES

- A. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Crane; Crane Energy Flow Solutions.
 - c. NIBCO INC.
 - d. Or approved equal.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.5 WALL HYDRANTS

A. Vacuum Breaker Wall Hydrants:

1. Standard: ASSE 1019, Type A or Type B.
2. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
3. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
4. Pressure Rating: 125 psig.
5. Operation: Loose key.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 1/2 or NPS 3/4.
8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.6 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.7 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. MIFAB, Inc.
 - c. Watts; a Watts Water Technologies company.
 - d. Or approved equal.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

1 PART 3 - EXECUTION

2 3.1 INSTALLATION

3 A. Install balancing valves in locations where they can easily be adjusted.

4 B. Install water-hammer arresters in water piping according to PDI-WH 201.

5 3.2 CONNECTIONS

6 A. Comply with requirements for ground equipment in Section 260526 "Grounding and
7 Bonding for Electrical Systems."

8 B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage
9 Electrical Power Conductors and Cables" for electrical connections.

10 3.3 FIELD QUALITY CONTROL

11 A. Perform the following tests and inspections:

12 1. Test each pressure vacuum breaker and reduced-pressure-principle backflow
13 preventer according to authorities having jurisdiction and the device's reference
14 standard.

15 B. Domestic water piping specialties will be considered defective if they do not pass tests
16 and inspections.

17 C. Prepare test and inspection reports.

18 3.4 ADJUSTING

19 A. Set field-adjustable pressure set points of water pressure-reducing valves.

20 B. Set field-adjustable flow set points of balancing valves.

21 C. Set field-adjustable temperature set points of temperature-actuated, water mixing
22 valves.

23 END OF SECTION

1 SECTION 221316

2 SANITARY WASTE AND VENT PIPING

3 PART 1 - GENERAL

4 1.1 SUMMARY

5 A. Section Includes:

- 6 1. Pipe, tube, and fittings.
7 2. Specialty pipe fittings.

8 B. Related Section:

- 9 1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and
10 structures outside the building.

11 1.2 PERFORMANCE REQUIREMENTS

- 12 A. Seismic Performance: Soil, waste, and vent piping and support and installation shall
13 withstand the effects of earthquake motions determined according to ASCE/SEI 7.

14 1.3 SUBMITTALS

- 15 A. Product Data: For each type of product indicated.

16 1.4 QUALITY ASSURANCE

- 17 A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- 18 B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related
19 Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic
20 drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

21 PART 2 - PRODUCTS

22 2.1 PIPING MATERIALS

- 23 A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube,
24 fitting materials, and joining methods for specific services, service locations, and pipe
25 sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
 - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Solvent Cement: ASTM D 2564.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- 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 following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

L. Install aboveground ABS piping according to ASTM D 2661.

M. Install aboveground PVC piping according to ASTM D 2665.

N. Install underground ABS and PVC piping according to ASTM D 2321.

O. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. 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.

- 1 B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil
2 Pipe and Fittings Handbook" for hubless-piping coupling joints.
- 3 C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use
4 ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- 5 D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and
6 thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt
7 threads. Torque bolts in cross pattern.
- 8 E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces.
9 Join pipe and fittings according to the following:
 - 10 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and
11 solvent cements.
 - 12 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 13 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

14 3.4 HANGER AND SUPPORT INSTALLATION

- 15 A. Comply with requirements for seismic-restraint devices specified in Section 220548
16 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- 17 B. Comply with requirements for pipe hanger and support devices and installation
18 specified in Section 220529 "Hangers and Supports for Plumbing Piping and
19 Equipment."
 - 20 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive
21 environments.
 - 22 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive
23 environments.
 - 24 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 25 4. Install individual, straight, horizontal piping runs:
 - 26 a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 27 b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 28 c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
- 29 C. Install hangers for PVC piping with the following maximum horizontal spacing and
30 minimum rod diameters:
 - 31 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 32 2. NPS 3: 48 inches with 1/2-inch rod.
 - 33 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
- 34 D. Install supports for vertical PVC piping every 48 inches.

- E. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

- 1 D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of
2 water-based latex paint.

3 3.9 PIPING SCHEDULE

- 4 A. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

- 5 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

- 6 B. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

- 7 1. Copper DWV tube, copper drainage fittings, and soldered joints for use in air
8 plenums.

- 9 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

- 10 C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the
11 following:

- 12 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

- 13 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and
14 coupled joints.

- 15 3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

16 END OF SECTION

1 SECTION 221319

2 SANITARY WASTE PIPING SPECIALTIES

3 PART 1 - GENERAL

4 1.1 SUMMARY

5 A. Section Includes:

- 6 1. Cleanouts.
7 2. Floor drains.
8 3. Roof flashing assemblies.
9 4. Miscellaneous sanitary drainage piping specialties.
10 5. Flashing materials.

11 1.2 SUBMITTALS

- 12 A. Product Data: For each type of product indicated. Include rated capacities, operating
13 characteristics, and accessories for grease interceptors.

14 1.3 QUALITY ASSURANCE

- 15 A. Drainage piping specialties shall bear label, stamp, or other markings of specified
16 testing agency.

17 PART 2 - PRODUCTS

18 2.1 CLEANOUTS

19 A. Exposed Cast-Iron Cleanouts:

- 20 1. Manufacturers: Subject to compliance with requirements, provide products by one
21 of the following:
22 a. Jay R. Smith Mfg. Co.
23 b. MIFAB, Inc.
24 c. Watts; a Watts Water Technologies company.
25 d. Or approved equal.
26 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
27 3. Size: Same as connected drainage piping

4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Watts; a Watts Water Technologies company.
 - d. Or approved equal.
2. Standard: ASME A112.36.2M for adjustable housing cast-iron soil pipe with cast-iron ferrule cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing, cast-iron soil pipe with cast-iron ferrule.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Spigot.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. MIFAB, Inc.
 - c. Watts; a Watts Water Technologies company.
 - d. Or approved equal.
2. Standard: ASME A112.6.3 with backwater valve.
3. Pattern: Area drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.

7. Clamping Device: Not required.
8. Outlet: Bottom.
9. Backwater Valve: Drain-outlet type.
10. Coating on Interior and Exposed Exterior Surfaces: Not required.
11. Sediment Bucket: .
12. Top or Strainer Material: Bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Round.
15. Top Loading Classification: Medium Duty.
16. Funnel: Not required.
17. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
18. Trap Material: Bronze.
19. Trap Pattern: Standard P-trap.
20. Trap Features: Cleanout.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

B. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

C. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.4 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.

- 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

- 1 E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend
2 through roof.
- 3 F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- 4 G. Assemble open drain fittings and install with top of hub 1 inch above floor.
- 5 H. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- 6 I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal
7 primer connection.
 - 8 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 9 2. Size: Same as floor drain inlet.
- 10 J. Install sleeve flashing device with each riser and stack passing through floors with
11 waterproof membrane.
- 12 K. Install vent caps on each vent pipe passing through roof.

13 3.2 CONNECTIONS

- 14 A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for
15 piping installation requirements. Drawings indicate general arrangement of piping,
16 fittings, and specialties.
- 17 B. Install piping adjacent to equipment to allow service and maintenance.

18 3.3 FLASHING INSTALLATION

- 19 A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes
20 are required. Join flashing according to the following if required:
 - 21 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or
22 thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- 23 B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in
24 floors and roofs with waterproof membrane.
 - 25 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10
26 inches, and skirt or flange extending at least 8 inches around pipe.
 - 27 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around
28 sleeve.
 - 29 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8
30 inches around specialty.
- 31 C. Set flashing on floors and roofs in solid coating of bituminous cement.

- 1 D. Secure flashing into sleeve and specialty clamping ring or device.
- 2 E. Install flashing for piping passing through roofs with counterflashing or commercially
3 made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
- 4 F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure
5 flashing into cast-iron sleeve having calking recess.

6 3.4 PROTECTION

- 7 A. Protect drains during remainder of construction period to avoid clogging with dirt or
8 debris and to prevent damage from traffic or construction work.
- 9 B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

10 END OF SECTION

1 SECTION 221413

2 FACILITY STORM DRAINAGE PIPING

3 PART 1 - GENERAL

4 1.1 SUMMARY

5 A. Section Includes:

- 6 1. Pipe, tube, and fittings.
7 2. Specialty pipe fittings.

8 1.2 PERFORMANCE REQUIREMENTS

- 9 A. Seismic Performance: Storm drainage piping and support and installation shall
10 withstand the effects of earthquake motions determined according to ASCE/SEI 7

11 1.3 SUBMITTALS

- 12 A. Product Data: For each type of product indicated.

13 1.4 QUALITY ASSURANCE

- 14 A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
15 B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related
16 Materials," for plastic piping components. Include marking with "NSF-drain" for plastic
17 drain piping and "NSF-sewer" for plastic sewer piping.

18 PART 2 - PRODUCTS

19 2.1 PIPING MATERIALS

- 20 A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube,
21 fitting materials, and joining methods for specific services, service locations, and pipe
22 sizes.

23 2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- 24 A. Pipe and Fittings: ASTM A 74, Service class.

1 B. Gaskets: ASTM C 564, rubber.

2 2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

3 A. Pipe and Fittings: ASTM A 888 or CISPI 301.

4 B. CISPI, Hubless-Piping Couplings:

5 1. Manufacturers: Subject to compliance with requirements, provide products by one
6 of the following:

7 a. Charlotte Pipe and Foundry Company.

8 b. Fernco Inc.

9 c. MIFAB, Inc.

10 d. Mission Rubber Company, LLC; a division of MCP Industries.

11 2. Standards: ASTM C 1277 and CISPI 310.

12 3. Description: Stainless-steel corrugated shield with stainless-steel bands and
13 tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe
14 stop.

15 2.4 COPPER TUBE AND FITTINGS

16 A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

17 B. Copper Drainage Fittings: ASME B16.23, cast-copper fittings or ASME B16.29,
18 wrought-copper, solder-joint fittings.

19 C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

20 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-
21 free, 1/8-inch maximum thickness unless thickness or specific material is
22 indicated.

23 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

24 D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

25 2.5 ABS PIPE AND FITTINGS

26 A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

27 B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

28 C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent
29 patterns.

1 D. Solvent Cement: ASTM D 2235.

- 2 1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated
- 3 according to 40 CFR 59, Subpart D (EPA Method 24).
- 4 2. Solvent cement shall comply with the testing and product requirements of the
- 5 California Department of Health Services' "Standard Practice for the Testing of
- 6 Volatile Organic Emissions from Various Sources Using Small-Scale
- 7 Environmental Chambers."

8 2.6 PVC PIPE AND FITTINGS

9 A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

10 B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

11 C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent

12 patterns and to fit Schedule 40 pipe.

13 D. Adhesive Primer: ASTM F 656.

- 14 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated
- 15 according to 40 CFR 59, Subpart D (EPA Method 24).
- 16 2. Adhesive primer shall comply with the testing and product requirements of the
- 17 California Department of Health Services' "Standard Practice for the Testing of
- 18 Volatile Organic Emissions from Various Sources Using Small-Scale
- 19 Environmental Chambers."

20 E. Solvent Cement: ASTM D 2564.

- 21 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated
- 22 according to 40 CFR 59, Subpart D (EPA Method 24).
- 23 2. Solvent cement shall comply with the testing and product requirements of the
- 24 California Department of Health Services' "Standard Practice for the Testing of
- 25 Volatile Organic Emissions from Various Sources Using Small-Scale
- 26 Environmental Chambers."

27 2.7 SPECIALTY PIPE FITTINGS

28 A. Transition Couplings:

- 29 1. General Requirements: Fitting or device for joining piping with small differences
- 30 in OD's or of different materials. Include end connections same size as and
- 31 compatible with pipes to be joined.
- 32 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-
- 33 piping-system fitting.
- 34 3. Unshielded, Nonpressure Transition Couplings:

1 a. Manufacturers: Subject to compliance with requirements, provide products
2 by one of the following:

3 1) Dallas Specialty & Mfg. Co.

4 2) Fernco Inc.

5 3) Mission Rubber Company, LLC; a division of MCP Industries.

6 b. Standard: ASTM C 1173.

7 c. Description: Elastomeric, sleeve-type, reducing or transition pattern.
8 Include shear ring and corrosion-resistant-metal tension band and tightening
9 mechanism on each end.

10 d. Sleeve Materials:

11 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.

12 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926,
13 PVC.

14 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material
15 compatible with pipe materials being joined.

16 4. Shielded, Nonpressure Transition Couplings:

17 a. Manufacturers: Subject to compliance with requirements, provide products
18 by the following:

19 1) Cascade Waterworks Mfg. Co.

20 b. Standard: ASTM C 1460.

21 c. Description: Elastomeric or rubber sleeve with full-length, corrosion-
22 resistant outer shield and corrosion-resistant-metal tension band and
23 tightening mechanism on each end.

24 PART 3 - EXECUTION

25 3.1 EARTH MOVING

26 A. Comply with requirements for excavating, trenching, and backfilling specified in
27 Section 312000 "Earth Moving."

28 3.2 PIPING INSTALLATION

29 A. Drawing plans, schematics, and diagrams indicate general location and arrangement of
30 piping systems. Indicated locations and arrangements were used to size pipe and
31 calculate friction loss, expansion, pump sizing, and other design considerations. Install
32 piping as indicated unless deviations from layout are approved on coordination
33 drawings.

- 1 B. Install piping in concealed locations unless otherwise indicated and except in equipment
2 rooms and service areas.
- 3 C. Install piping indicated to be exposed and piping in equipment rooms and service areas
4 at right angles or parallel to building walls. Diagonal runs are prohibited unless
5 specifically indicated otherwise.
- 6 D. Install piping above accessible ceilings to allow sufficient space for ceiling panel
7 removal.
- 8 E. Install piping at indicated slopes.
- 9 F. Install piping free of sags and bends.
- 10 G. Install fittings for changes in direction and branch connections.
- 11 H. Install seismic restraints on piping. Comply with requirements for seismic-restraint
12 devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing
13 Piping and Equipment."
- 14 I. Make changes in direction for storm drainage piping using appropriate branches, bends,
15 and long-sweep bends. Do not change direction of flow more than 90 degrees. Use
16 proper size of standard increasers and reducers if pipes of different sizes are connected.
17 Reducing size of drainage piping in direction of flow is prohibited.
- 18 J. Lay buried building storm drainage piping beginning at low point of each system.
19 Install true to grades and alignment indicated, with unbroken continuity of invert. Place
20 hub ends of piping upstream. Install required gaskets according to manufacturer's
21 written instructions for use of lubricants, cements, and other installation requirements.
22 Maintain swab in piping and pull past each joint as completed.
- 23 K. Install storm drainage piping at the following minimum slopes unless otherwise
24 indicated:
- 25 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3
26 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
27 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- 28 L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings
29 Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- 30 1. Install encasement on underground piping according to ASTM A 674 or
31 AWWA C105.
- 32 M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- 33 N. Install aboveground ABS piping according to ASTM D 2661.

- 1 O. Install aboveground PVC piping according to ASTM D 2665.
- 2 P. Install underground ABS and PVC piping according to ASTM D 2321.
- 3 Q. Plumbing Specialties:
- 4 1. Install backwater valves in storm drainage gravity-flow piping. Comply with
5 requirements for backwater valves specified in Section 221423 "Storm Drainage
6 Piping Specialties."
- 7 2. Install cleanouts at grade and extend to where building storm drains connect to
8 building storm sewers in storm drainage gravity-flow piping. Install cleanout
9 fitting with closure plug inside the building in storm drainage force-main piping.
10 Comply with requirements for cleanouts specified in Section 221423 "Storm
11 Drainage Piping Specialties."
- 12 3. Install drains in storm drainage gravity-flow piping. Comply with requirements
13 for drains specified in Section 221423 "Storm Drainage Piping Specialties."
- 14 R. Do not enclose, cover, or put piping into operation until it is inspected and approved by
15 authorities having jurisdiction.
- 16 S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with
17 requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for
18 Plumbing Piping."
- 19 T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with
20 requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for
21 Plumbing Piping."
- 22 U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with
23 requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing
24 Piping."
- 25 3.3 JOINT CONSTRUCTION
- 26 A. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's
27 "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- 28 B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil
29 Pipe and Fittings Handbook" for hubless-piping coupling joints.
- 30 C. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure.
31 Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy
32 solder.
- 33 D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and
34 thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt
35 threads. Torque bolts in cross pattern.

1 E. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces.
2 Join pipe and fittings according to the following:

- 3 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and
4 solvent cements.
- 5 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
- 6 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

7 3.4 SPECIALTY PIPE FITTING INSTALLATION

8 A. Transition Couplings:

- 9 1. Install transition couplings at joints of piping with small differences in OD's.
- 10 2. In Drainage Piping: Unshielded and Shielded, nonpressure transition couplings.

11 3.5 HANGER AND SUPPORT INSTALLATION

12 A. Comply with requirements for seismic-restraint devices specified in Section 220548
13 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

14 B. Comply with requirements for pipe hanger and support devices and installation
15 specified in Section 220529 "Hangers and Supports for Plumbing Piping and
16 Equipment."

- 17 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive
18 environments.
- 19 2. Install stainless-steel pipe hangers for horizontal piping in corrosive
20 environments.
- 21 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive
22 environments.
- 23 4. Install stainless-steel pipe support clamps for vertical piping in corrosive
24 environments.
- 25 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
- 26 6. Individual, Straight, Horizontal Piping Runs:
 - 27 a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 28 b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 29 c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
- 30 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44,
31 pipe rolls. Support pipe rolls on trapeze.
- 32 8. Base of Vertical Piping: MSS Type 52, spring hangers.

33 C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and
34 coupling.

- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 5. NPS 6: 10 feet with 5/8-inch rod.
 6. NPS 8: 10 feet with 3/4-inch rod.
- I. Install supports for vertical copper tubing every 10 feet.
- J. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 2. NPS 3: 48 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- K. Install supports for vertical ABS and PVC piping every 48 inches.
- L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- 1 B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition
2 fitting to join dissimilar piping materials.
- 3 C. Connect storm drainage piping to roof drains and storm drainage specialties.
- 4 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with
5 cover flush with floor.
- 6 2. Install horizontal backwater valves with cleanout cover flush with floor
- 7 3. Comply with requirements for backwater valves cleanouts and drains specified in
8 Section 221423 "Storm Drainage Piping Specialties."
- 9 D. Where installing piping adjacent to equipment, allow space for service and maintenance
10 of equipment.

11 3.7 IDENTIFICATION

- 12 A. Identify exposed storm drainage piping. Comply with requirements for identification
13 specified in Section 220553 "Identification for Plumbing Piping and Equipment."

14 3.8 FIELD QUALITY CONTROL

- 15 A. During installation, notify authorities having jurisdiction at least 24 hours before
16 inspection must be made. Perform tests specified below in presence of authorities
17 having jurisdiction.
- 18 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or
19 closing-in after roughing-in.
- 20 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to
21 observe tests specified below and to ensure compliance with requirements.
- 22 B. Reinspection: If authorities having jurisdiction find that piping will not pass test or
23 inspection, make required corrections and arrange for reinspection.
- 24 C. Reports: Prepare inspection reports and have them signed by authorities having
25 jurisdiction.
- 26 D. Test storm drainage piping according to procedures of authorities having jurisdiction or,
27 in absence of published procedures, as follows:
- 28 1. Test for leaks and defects in new piping and parts of existing piping that have
29 been altered, extended, or repaired. If testing is performed in segments, submit
30 separate report for each test, complete with diagram of portion of piping tested.
- 31 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm
32 drainage piping until it has been tested and approved. Expose work that was
33 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 until 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.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.
 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 6. Dissimilar Pipe-Material Couplings: Unshielded or Shielded, nonpressure transition couplings.
- C. Underground storm drainage piping NPS 6 and smaller shall be any of the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.
 3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 5. Dissimilar Pipe-Material Couplings: Unshielded or Shielded, nonpressure transition couplings.

END OF SECTION

1 SECTION 22 15 13
2 GENERAL-SERVICE COMPRESSED-AIR PIPING

3 PART 1 - GENERAL

4 1.1 RELATED DOCUMENTS

- 5 A. Drawings and general provisions of the Contract, including General and Supplementary
6 Conditions and Division 01 Specification Sections, apply to this Section.

7 1.2 SUMMARY

- 8 A. This Section includes piping and related specialties for general-service compressed-air
9 systems operating at 150 psig or less.

- 10 B. Related Sections include the following:

- 11 1. Section 221519 "General-Service Packaged Air Compressors and Receivers" for
12 general-service air compressors and accessories.

13 1.3 DEFINITIONS

14 1.4 ACTION SUBMITTALS

- 15 A. Product Data: For the following:

- 16 1. Pipes, fittings, and valves.
17 2. Flexible pipe connectors.
18 3. Safety valves.
19 4. Pressure regulators. Include rated capacities and operating characteristics.
20 5. Automatic drain valves.
21 6. Filters. Include rated capacities and operating characteristics.
22 7. Lubricators. Include rated capacities and operating characteristics.
23 8. Quick couplings.
24 9. Hose assemblies.

25 1.5 CLOSEOUT SUBMITTALS

- 26 A. Operation and Maintenance Data: For general-service compressed-air piping specialties
27 to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. ASME Compliance:

1. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Schedule 40, Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded according to ASME B1.20.1.

1. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.

2.2 VALVES

A. Two-Piece, Brass Ball Valves with Full Port and Stainless-Steel Trim:

1. Description

- a. Standard: MSS SP-110
- b. CWP Rating: 600 psig.
- c. Body Design: Two-piece.
- d. Body Material: Forged brass.
- e. Ends: Threaded.
- f. Seats:
- g. PTFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

2.3 FLEXIBLE PIPE CONNECTORS

A. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: 200 psig minimum.
2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
3. End Connections, NPS 2-1/2 and Larger: Flanged steel nipple.

2.4 SPECIALTIES

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
 - 1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.
- C. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate.
- D. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket.

2.5 QUICK COUPLINGS

- A. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- B. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.
 - 1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
 - 2. Plug End: Straight-through type with barbed outlet for attaching hose.

2.6 HOSE ASSEMBLIES

- A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.
 - 1. Hose: Reinforced single- or double-wire-braid, CR-covered hose for compressed-air service.
 - 2. Hose Clamps: Stainless-steel clamps or bands.
 - 3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.

4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

2.7 Retractable Hose Reel

A. Description – Heavy duty spring retractable hose reel

1. ½" id hose for compressed air
2. Hose length 50 inches
3. Formed high grade steel base and guide area
4. Suitable for mounting horizontal or vertical

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Compressed-Air Piping: Use the following piping materials:

1. NPS 2 and Smaller: Schedule 40, black steel pipe; threaded, malleable-iron fittings; and threaded joints.

B. Drain Piping: Use the following piping materials:

1. NPS 3 and Smaller: Type L copper tube; wrought-copper fittings; and brazed or soldered joints.

3.2 VALVE APPLICATIONS

A. Metal General-Duty Valves: Comply with requirements and use valve types specified in "Valve Applications" Articles in Section 220523 "Valves for Plumbing Piping," according to the following:

1. Compressed Air: Ball valve types specified for low-pressure compressed air.
2. Equipment Isolation NPS 2 and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- 1 B. Install piping concealed from view and protected from physical contact by building
2 occupants, unless otherwise indicated and except in equipment rooms and service areas.
- 3 C. Install piping indicated to be exposed and piping in equipment rooms and service areas
4 at right angles or parallel to building walls. Diagonal runs are prohibited, unless
5 otherwise indicated.
- 6 D. Install piping adjacent to equipment and machines to allow service and maintenance.
- 7 E. Install air and drain piping with 1 percent slope downward in direction of flow.
- 8 F. Install nipples, flanges, unions, transition and special fittings, and valves with pressure
9 ratings same as or higher than system pressure rating, unless otherwise indicated.
- 10 G. Install eccentric reducers where compressed-air piping is reduced in direction of flow,
11 with bottoms of both pipes and reducer fitting flush.
- 12 H. Install branch connections to compressed-air mains from top of main. Provide drain leg
13 and drain trap at end of each main and branch and at low points.
- 14 I. Install pressure gage on discharge piping from each air compressor and on each
15 receiver.
- 16 J. Install piping to permit valve servicing.
- 17 K. Install piping free of sags and bends.
- 18 L. Install fittings for changes in direction and branch connections.
- 19 M. Install sleeves for piping penetrations of walls, ceilings, and floors.
- 20 N. Install sleeve seals for piping penetrations of concrete walls and slabs.
- 21 O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

22 3.4 JOINT CONSTRUCTION

- 23 A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- 24 B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before
25 assembly.
- 26 C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
27 Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs
28 and restore full ID. Join pipe fittings and valves as follows:
 - 29 1. Apply appropriate tape or thread compound to external pipe threads unless dry
30 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.

3.5 VALVE INSTALLATION

- A. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.
- B. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

3.6 FLEXIBLE PIPE CONNECTOR INSTALLATION

- A. Install flexible pipe connectors in discharge piping of each air compressor.
- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.
- C. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

3.7 SPECIALTY INSTALLATION

- A. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- B. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.
- C. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters.
- D. Install quick couplings at piping terminals for hose connections.
- E. Install hose assemblies at hose connections.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

3.9 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

1 3.10 FIELD QUALITY CONTROL

2 A. Perform field tests and inspections.

3 B. Tests and Inspections:

4 1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts
5 of existing piping. Cap and fill general-service compressed-air piping with oil-
6 free dry air or gaseous nitrogen to pressure of 50 psig above system operating
7 pressure, but not less than 150 psig. Isolate test source and let stand for four hours
8 to equalize temperature. Refill system, if required, to test pressure; hold for two
9 hours with no drop in pressure.

10 2. Repair leaks and retest until no leaks exist.

11 3. Inspect filters and pressure regulators for proper operation.

12 C. Prepare test reports.

13 END OF SECTION 22 15 13

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1 SECTION 22 15 19
2 GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

3 PART 1 - GENERAL

4 1.1 RELATED DOCUMENTS

- 5 A. Drawings and general provisions of the Contract, including General and Supplementary
6 Conditions and Division 01 Specification Sections, apply to this Section.

7 1.2 SUMMARY

- 8 A. Section Includes:

- 9 1. Lubricated, reciprocating air compressors.
10 2. Refrigerant compressed-air dryers.

11 1.3 DEFINITIONS

- 12 A. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air
13 measured in acfm.
14 B. Standard Air: Free air at 68 deg F and 1 atmosphere before compression or expansion
15 and measured in scfm.

16 1.4 SUBMITTALS

- 17 A. Product Data: For each type of product.

- 18 1. Include rated capacities, operating characteristics, electrical characteristics, and
19 furnished specialties and accessories.

- 20 B. Shop Drawings:

- 21 1. Include diagrams for power, signal, and control wiring.

22 1.5 CLOSEOUT SUBMITTALS

- 23 A. Operation and Maintenance Data: For compressed-air equipment to include in operation
24 and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One for each belt-driven compressor.

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

2.2 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

- A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.

- B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.

1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
2. Motor Controllers: Full-voltage, combination magnetic type with under-voltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
3. Control Voltage: 120-V ac or less, using integral control power transformer.
4. Motor Overload Protection: Overload relay in each phase.
5. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
6. Instrumentation: Include discharge-air pressure gage, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gages, and control transformer.

C. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
2. Interior Finish: Corrosion-resistant coating.
3. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.

D. Mounting Frame: Fabricate mounting and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.3 LUBRICATED, RECIPROCATING AIR COMPRESSORS

A. Acceptable manufacturers: Quincy Compressor, Porter Cable, Rolair, Cambell Hausfeld.

B. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.

1. Submerged gear-type oil pump.
2. Oil filter.
3. Combined high discharge-air temperature and low lubrication-oil pressure switch.
4. Belt guard totally enclosing pulleys and belts.

C. Capacities and Characteristics:

1. Air Compressor(s): One single stage.
2. Discharge-Air Pressure: 125 psig. Mounting: Tank mounted.

3. Electrical Characteristics:

- a. Volts: 208
- b. Phase(s): Single
- c. Hertz: 60

4. Receiver: ASME construction steel tank.

- a. Arrangement: Vertical.
- b. Capacity: 100 Gallons minimum
- c. Pressure Rating: 150 psig = minimum.

2.4 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

- 1. Enclosure: Open, drip-proof.
 - 2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load does not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Equipment Mounting:

- 1. Install air compressors on cast-in-place concrete equipment base(s).
- B. Install compressed-air equipment on elastomeric isolation pads.
- C. Arrange equipment so controls and devices are accessible for servicing.
- D. Maintain manufacturer's recommended clearances for service and maintenance.
- E. Install the following devices on compressed-air equipment:
 - 1. Pressure Gage and Safety Valve: Install on each compressed-air receiver.
 - 2. Automatic Drain Valves: Discharge condensate over nearest floor drain.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221513 "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to machine, allow space for service and maintenance.

3.3 IDENTIFICATION

- A. Identify general-service air compressors and components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check for lubricating oil in lubricated-type equipment.
3. Check belt drives for proper tension.
4. Verify that air-compressor inlet filters and piping are clear.
5. Check for equipment vibration-control supports and flexible pipe connectors, and verify that equipment is properly attached to substrate.
6. Check safety valves for correct settings. Ensure that settings are higher than air-compressor discharge pressure, but not higher than rating of system components.
7. Drain receiver tanks.
8. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
9. Test and adjust controls and safeties.

3.5 DEMONSTRATION

- #### A. Train Owner's maintenance personnel to adjust, operate, and maintain air compressors and air dryers.

END OF SECTION 22 15 19

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SECTION 224213.13

COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets Floor mounted, bottom outlet, top spud.

1. Manufacturers and equipment criteria listed on equipment schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

- 1 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet
2 water closets.
- 3 2. Use carrier supports with waste-fitting assembly and seal.
- 4 3. Install wall-mounted, back-outlet water-closet supports with waste-fitting
5 assembly and waste-fitting seals; and affix to building substrate.
- 6 C. Install toilet seats on water closets.
- 7 D. Joint Sealing:
- 8 1. Seal joints between water closets and walls and floors using sanitary-type, one-
9 part, mildew-resistant silicone sealant.
- 10 2. Match sealant color to water-closet color.
- 11 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- 12 3.2 CONNECTIONS
- 13 A. Connect water closets with water supplies and soil, waste, and vent piping. Use size
14 fittings required to match water closets.
- 15 B. Comply with water piping requirements specified in Section 221116 "Domestic Water
16 Piping."
- 17 C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary
18 Waste and Vent Piping."
- 19 D. Where installing piping adjacent to water closets, allow space for service and
20 maintenance.
- 21 3.3 ADJUSTING
- 22 A. Operate and adjust water closets and controls. Replace damaged and malfunctioning
23 water closets, fittings, and controls.
- 24 B. Adjust water pressure at flushometer valves to produce proper flow.
- 25 3.4 CLEANING AND PROTECTION
- 26 A. Clean water closets and fittings with manufacturers' recommended cleaning methods
27 and materials.
- 28 B. Install protective covering for installed water closets and fittings.

1 C. Do not allow use of water closets for temporary facilities unless approved in writing by
2 Owner.

3 END OF SECTION

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SECTION 224216.13

COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

PART 2 - PRODUCTS

2.1 WALL MOUNTED LAVATORY

A. Lavatory details / specifications are located on the equipment schedule.

2.2 MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets details / specifications are located on the equipment schedules.

2.3 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key
- F. Risers:
 - 1. NPS 3/8.
 - 2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.4 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 1-1/2 by NPS 1-1/4.
 - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- thick brass tube to wall and chrome-plated, brass or steel wall flange.
 - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

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 lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.

- 1 B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning
2 methods and materials.
- 3 C. Provide protective covering for installed lavatories and fittings.
- 4 D. Do not allow use of lavatories for temporary facilities unless approved in writing by
5 Owner.

6 END OF SECTION

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.

- C. Service Factor: 1.15.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating.
- G. Insulation: Class F.
- H. Code Letter Designation:
 - 1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.

- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

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SECTION 230517

SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.

1.2 ACTION SUBMITTALS

- ###### A. Product Data:
- For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/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. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 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.
- 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- C. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - 2. Interior Partitions:
 - a. Piping Smaller Than NPS 6: PVC-pipe sleeves.

END OF SECTION 230517

SECTION 230518

ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.

1.2 ACTION SUBMITTALS

- ###### A. Product Data:
- For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- ###### A. One-Piece, Cast-Brass Type:
- With polished, chrome-plated finish and setscrew fastener.

PART 3 - EXECUTION

3.1 INSTALLATION

- ###### A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- ###### B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

- g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
- h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
- j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
- k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

SECTION 230523.12

BALL VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.1 for power piping valves.
5. ASME B31.9 for building services piping valves.

Refer to HVAC valve schedule articles for applications of valves.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Types:

1. Handlever: For quarter-turn valves smaller than NPS 4.

G. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.

3. Memory stops that are fully adjustable after insulation is applied.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece Brass Ball Valves with Full Port and Brass Trim:

1. Acceptable Manufacturers: Apollo, Crane, Nibco, Watts
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. Select valves with the following end connections:
 1. For Steel Piping, NPS 2 and Smaller: Threaded ends.

END OF SECTION 230523.12

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fastener systems.
4. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria 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 capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 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.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.5 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. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers,

NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

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. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 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: 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 a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting", and Section 099123 "Interior Painting".
- C. Welds, bolted connections, and abraded areas and apply galvanizing-repair paint to 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. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use padded hangers for piping that is subject to scratching.
- G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 3. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
- H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- L. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

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SECTION 230548

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Housed-spring isolators.
4. Spring hangers.
5. Mechanical anchor bolts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. Mason Industries, Inc.
 - c. Vibration Eliminator Co., Inc.
 - d. Vibration Isolation.
2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Ribbed pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.

2.2 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. Mason Industries, Inc.
 - c. Vibration Eliminator Co., Inc.
 - d. Vibration Isolation.
2. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.3 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. Mason Industries, Inc.
 - c. Vibration Eliminator Co., Inc.
 - d. Vibration Isolation.
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. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Top housing with attachment and leveling bolt.

2.4 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. Mason Industries, Inc.
 - c. Vibration Eliminator Co., Inc.
 - d. Vibration Isolation.
 2. 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.
 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.
 7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- D. Equipment Restraints:
 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Piping Restraints:
 1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.

- G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- K. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.

- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.4 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.

END OF SECTION 230548

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Craftmark Pipe Markers.
 - c. Kolbi Pipe Marker Co.
 - d. LEM Products Inc.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. 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-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brady Corporation.
 - 2. Craftmark Pipe Markers.
 - 3. Kolbi Pipe Marker Co.
 - 4. LEM Products Inc.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include 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: Size letters according to ASME A13.1 for piping.

2.3 DUCT LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brady Corporation.
 - 2. Craftmark Pipe Markers.
 - 3. Kolbi Pipe Marker Co.
 - 4. LEM Products Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.

- D. Background Color: White.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Pipe Label Locations: 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 and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Refrigerant Piping: Black letters on a safety-white background

3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated, self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
1. Blue: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Green For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

1.3 ACTION SUBMITTALS

A. LEED Submittals:

1. Air-Balance Report for Prerequisite IEQ 1: Documentation indicating that work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
2. TAB Report for Prerequisite EA 2: Documentation indicating that work complies with ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.4 INFORMATIONAL SUBMITTALS

- A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- B. Certified TAB reports.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC, NEBB or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB, or TABB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB, or TABB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in

AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design."
Compare results with the design data and installed conditions.

- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Duct systems are complete with terminals installed.
 - b. Volume, smoke, and fire dampers are open and functional.
 - c. Clean filters are installed.
 - d. Fans are operating, free of vibration, and rotating in correct direction.
 - e. Automatic temperature-control systems are operational.
 - f. Ceilings are installed.
 - g. Windows and doors are installed.
 - h. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.

- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
 - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.

2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

3.6 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.7 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 1. Fan curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.

- c. Description of system operation sequence if it varies from the Contract Documents.
- 12. Nomenclature sheets for each item of equipment.
- 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
- 14. Notes to explain why certain final data in the body of reports vary from indicated values.
- 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 - 1. Quantities of outdoor, supply, return, and exhaust airflows.
 - 2. Water and steam flow rates.
 - 3. Duct, outlet, and inlet sizes.
 - 4. Pipe and valve sizes and locations.
 - 5. Terminal units.
 - 6. Balancing stations.
 - 7. Position of balancing devices.
- E. Apparatus-Coil Test Reports:
 - 1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
 - 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.

- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.

F. Gas-fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Fuel type in input data.
- g. Output capacity in Btu/h.
- h. Ignition type.
- i. Burner-control types.
- j. Motor horsepower and rpm.
- k. Motor volts, phase, and hertz.
- l. Motor full-load amperage and service factor.
- m. Sheave make, size in inches, and bore.
- n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Entering-air temperature in deg F.
- c. Leaving-air temperature in deg F.
- d. Air temperature differential in deg F.
- e. Entering-air static pressure in inches wg.
- f. Leaving-air static pressure in inches wg.
- g. Air static-pressure differential in inches wg.
- h. Low-fire fuel input in Btu/h.
- i. High-fire fuel input in Btu/h.
- j. Manifold pressure in psig.
- k. High-temperature-limit setting in deg F.
- l. Operating set point in Btu/h.
- m. Motor voltage at each connection.
- n. Motor amperage for each phase.
- o. Heating value of fuel in Btu/h.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Motor Data:
- a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
- a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.

3.8 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of commissioning authority.

- B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 - 3. If the second verification also fails, Owner may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- F. Prepare test and inspection reports.

3.9 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713
DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 5. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 - 6. Outdoor, exposed supply and return.
- B. Related Sections:
 - 1. Section 230716 "HVAC Equipment Insulation."
 - 2. Section 230719 "HVAC Piping Insulation."
 - 3. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
- D. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.

- b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Foster Brand; H. B. Fuller Construction Products.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.

2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Ideal Tape Co., Inc., an American Biltrite Company.
 - c. Knauf Insulation.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.7 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. ITW Insulation Systems; Illinois Tool Works, Inc.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) AGM Industries, Inc.
 - 2) Gemco.

- b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

- c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

- d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

- D. Wire: 0.080-inch nickel-copper alloy.

2.8 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.6 FINISHES

- A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.

4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
7. Outdoor, exposed supply and return.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, inches 2 inches and 0.75-lb/cu. ft. nominal density.
- D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- E. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- F. Exposed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

3.10 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 1.5-lb/cu. Ft. nominal density.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 1. Aluminum, Corrugated: .020 inch thick.

END OF SECTION 230713

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SECTION 230719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."
 - 2. Section 230716 "HVAC Equipment Insulation."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. 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.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. Foster Brand; H. B. Fuller Construction Products.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 SEALANTS

A. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Proto Corporation.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.5 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. 3M Industrial Adhesives and Tapes Division.
 - b. Or Approved equal.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.6 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. Or Approved equal

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular

- surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.7 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to two locations of straight pipe, two locations of welded fittings for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be the following:
 1. Flexible Elastomeric: 2 inches thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. PVC: 20 mils thick.
- D. Piping, Exposed:
 - 1. PVC 20 mils thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. PVC: 30 mils thick.

END OF SECTION 230719

SECTION 230923

DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. **Oneida standard manufacturer for Direct Digital Controls is Schneider Electric – SmartStruxure Solution. Controls will be by Owner’s standard vendor under a separate contract. All Contractors bidding the HVAC portion of the work will be required to coordinate with the Oneida Project Manager Dan Skenandore (Phone: 920-869-4550, E-mail: dskenan1@oneidanation.org) and Schneider Electric. Schneider Electric contact information shall be provided by Dan Skenandore.**
- B. Related Requirements:
 - 1. Section 230993 "Sequence of Operations for HVAC Controls" for control sequences in DDC systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Schneider Electric – SmartStruxure Solution DDC System by Oneida Nation’s standard Controls Vendor.

2.2 DDC SYSTEM DESCRIPTION

- A. The following information contained within the “Products” Section of this specification section is for reference only to outline the basic system component and operating parameters of the DDC System standard vendor installed DDC system under a separate contract between the Oneida Nation and their standard DDC System Vendor, Schneider Electric.
- B. Microprocessor-based monitoring and control including analog/digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices to achieve a set of predefined conditions.
 - 1. DDC system shall consist of a high-speed, peer-to-peer network of distributed DDC controllers, other network devices, operator interfaces, and software.
- 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.

2.3 WEB ACCESS

A. DDC system shall be Web based or Web compatible.

1. Web-Based Access to DDC System:

- a. DDC system software shall be based on server thin-client architecture, designed around open standards of Web technology. DDC system server shall be accessed using a Web browser over DDC system network, using Owner's LAN, and remotely over Internet or through Owner's LAN.
- b. Intent of thin-client architecture is to provide operators complete access to DDC system via a Web browser. No special software other than a Web browser shall be required to access graphics, point displays, and trends; to configure trends, points, and controllers; and to edit programming.
- c. Web access shall be password protected.

2. Web-Compatible Access to DDC System:

- a. Operator workstation and or server shall perform overall system supervision and configuration, graphical user interface, management report generation, and alarm annunciation.
- b. DDC system shall support Web browser access to building data. Operator using a standard Web browser shall be able to access control graphics and change adjustable set points.
- c. Web access shall be password protected.

2.4 PERFORMANCE REQUIREMENTS

A. The standard DDC system Vendor shall engage a qualified professional to design DDC system to satisfy requirements indicated.

1. System Performance Objectives:

- a. DDC system shall manage HVAC systems.
- b. DDC system control shall operate HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.
- c. DDC system shall respond to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
- d. DDC system shall operate while unattended by an operator and through operator interaction.
- e. DDC system shall record trends and transaction of events and produce report information such as performance, energy, occupancies, and equipment operation.

PART 3 - EXECUTION

A. The DDC System installation work shall be performed by Oneida Nation's standard vendor, Schneider Electric per the terms of another contract between the Oneida Nation and Schneider Electric.

END OF SECTION 230923

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes control sequences for DDC for HVAC systems, subsystems, and equipment.
- B. Related Requirements:
 - 1. Section 230923 "DDC Systems for HVAC" for control equipment.

1.2 SEQUENCES OF OPERATION

- A. Temperature Set-points: This is a list of anticipated space temperature set-points to be maintained. All of these set-points shall be field adjustable by the owner as required upon completion of construction.

<u>Occupied:</u>	<u>Heating:</u>	<u>Cooling:</u>
Office:	70 Deg. Fahrenheit	74 Deg. Fahrenheit
Garage:	60 Deg. Fahrenheit	N/A
Storage:	60 Deg. Fahrenheit	N/A
Workshop:	60 Deg. Fahrenheit	N/A

<u>Unoccupied:</u>	<u>Heating:</u>	<u>Cooling:</u>
Office:	60 Deg. Fahrenheit	82 Deg. Fahrenheit
Garage:	50 Deg. Fahrenheit	N/A
Storage:	50 Deg. Fahrenheit	N/A
Workshop:	50 Deg. Fahrenheit	N/A

BUILDING OCCUPANCY SCHEDULE:

Equipment required to operate during building occupancy shall be provided with hard-wired programmable timers. Timers shall be programmed by this contractor based on building schedule to be provided by owner.

ANTI-CYCLING:

When HVAC equipment or a sequence is specified to be started and stopped by a temperature set-point, packaged controls shall have anti-cycling protection.

DAMPER INTERLOCKS FOR FANS WITH STARTERS:

For fan systems with magnetic starters and shutoff dampers, the damper interlock shall be hardwired in such a way that the damper shall open if the fan starter hand / off / auto switch is in the hand or in the auto position and being called to start.

THERMOSTATS AND SENSORS:

All devices and equipment including terminal units, specified to be controlled in a control sequence by a thermostat or sensor, shall be provided with a thermostat or sensor, whether or not the device is indicated on the plans. Consult the HVAC design engineer for the thermostat or sensor location when these are not shown on plans.

B. Sequences of Operation:

- Electric Wall Heater:

On a drop in space temperature below space temperature set-point (as determined by the unit thermostat), the electric wall heater heating element and fan shall energize per manufacturer's control sequence to maintain space temperature set-point. On an increase in the space temperature above the space temperature set-point the electric wall heater heating element and fan shall de-energize.

- Toilet Room / General Exhaust Fans:

OCCUPIED:

During the "OCCUPIED" period (as determined by the DDC / BAS system or timeclock) the exhaust fan shall be "ON".

UNOCCUPIED:

During the "UNOCCUPIED" period (as determined by the DDC / BAS system or timeclock) the exhaust fan shall be "OFF".

- Split AC / Heating System (Ducted Fan Coil):

OCCUPIED:

During the "OCCUPIED" period (as indicated by the DDC / BAS or timeclock) the motorized damper controlling the outside air ductwork shall be OPEN. The supply fan on the ducted fan coil unit shall be "ON" and the associated heat pump shall operate in heating or cooling mode to maintain the occupied space temperature set-point (as determined by the thermostat).

UNOCCUPIED:

During the "UNOCCUPIED" period (as indicated by the DDC / BAS or timeclock) the motorized damper controlling the outside air ductwork shall be CLOSED. The supply fan on the ducted fan coil unit shall be "ON" and the associated heat pump shall operate in heating or cooling mode to maintain the unoccupied space temperature set-point (as determined by the thermostat).

- Gas Fired Unit Heaters:

OCCUPIED:

During the "OCCUPIED" period (as determined by the DDC / BAS or timeclock) the gas fired unit heater gas valve, burner, and fan shall operate to maintain the OCCUPIED space temperature set-point when the space drops below the space temperature set-point. On an increase in space temperature above the space temperature set-point the gas fired unit heater valve shall be closed and the unit burner and fan shall be "OFF".

UNOCCUPIED:

During the "UNOCCUPIED" period (as determined by the DDC / BAS or timeclock) the gas fired unit heater gas valve, burner, and fan shall operate to maintain the UNOCCUPIED space temperature set-point when the space drops below the space temperature set-point. On an increase in space temperature above the space temperature set-point the gas fired unit heater valve shall be closed and the unit burner and fan shall be "OFF".

- Garage Exhaust with/without Gas-Fired Make-Up Air Unit:

Garage exhaust system shall consist of the following components:

- Gas detection and control system
- Combination starter/disconnect with "Hand", "Off", "Auto" control input, and auxiliary control input.
- Exhaust fan with interlocked motorized damper.
- Gas Fired Make Up Air Unit interlocked to exhaust fan operation. (The residential garage exhaust system does not have tempered make-up air).
- Programmable timer.
- Spring wound manual timer.
- Solid state relays to accommodate various modes of operation.

Garage exhaust fan shall be controlled by gas detection system, scheduled minimum runtime (programmable timer), and manual switch (spring wound timer switch).

GAS FIRED MAKE-UP AIR UNIT:

The Gas Fired make-up air unit shall be interlocked to the garage exhaust fan and shall operate when the garage exhaust fan is in operation. The gas-fired make up air unit internal controls shall modulate the unit gas valve, gas fired burner, damper, and supply fan to maintain the space temperature set-point as indicated by the space thermostat / temperature sensor located in the space. The gas-fired make up air unit shall have a remote control panel mounted in the garage.

GAS DETECTION SYSTEM:

Gas detection and control system shall include the following:

- Remote mounted sensor(s) capable of monitoring CO and NO2. Sensors shall be wired by this contractor, and powered by 24V from gas detection controller. Sensor shall have visual indication of "normal operation", "high gas" condition, and "malfunction" condition. Contractor shall be responsible for providing sensor coverage as required to satisfy specified control sequence.
- Controller shall be capable of monitoring sensor quantity and type as required to provide coverage for ambulance garage in its entirety. Controller shall have integral relay (with adjustable timed delay) to start/stop associated exhaust fan (EF-2). Controller shall have visual indication of "normal operation", "high gas" condition, and "malfunction" condition.
- Audible and visual alarm shall be field adjustable.

The system controller shall continuously monitor its remote sensors. When an alarm condition is detected the controller shall delay exhaust fan contact closure for 30 seconds (adjustable). If the high gas condition persists for more than 30 seconds the exhaust fan contacts shall close. Fan relay shall be wired to "Auto" control input on fan starter. Fan contact shall remain closed for a minimum of 5 minutes (adjustable). Should the alarm condition remain after the minimum run time has timed out, the exhaust fan contacts shall remain closed (ON) and a second "alarm" set of contacts shall close. The second "alarm" set of contacts shall enable audible and visual alarms.

SCHEDULED MINIMUM RUNTIME:

Exhaust fan shall operate 5 hrs over a period 24 hrs in order to satisfy code requirements via a programmable timer. Timer to be programmed to run 13 minutes every 1 hr. Programmable timer shall be adjustable and capable of a minimum of 24 start/stop events (48 total events).

MANUAL SWITCH:

Exhaust fan shall be wired to a spring wound timer switch to override automatic system operation in order to ventilate garage during the summer or during truck wash operations. Spring wound timer switch shall have a minimum of 1 minute to a maximum of 60 minutes.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 231123

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig.

C. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

D. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. 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.

2.2 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
 - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 - 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 - 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
 - 4. Corrugated stainless-steel tubing with polymer coating.
 - 5. Operating-Pressure Rating: 0.5 psig.
 - 6. End Fittings: Zinc-coated steel.

7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.

6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Apollo Flow Controls; Conbraco Industries, Inc.
 - c. BrassCraft Manufacturing Co.; a Masco company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Canadian Meter Company Inc.
 - b. Eaton.
 - c. Harper Wyman Co.
 - d. Maxitrol Company.
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.

2.6 DIELECTRIC UNIONS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Capitol Manufacturing Company.
 - c. Jomar Valve.
 - d. WATTS.
2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: [125 psig minimum at 180 deg F] [150 psig] [250 psig].
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.7 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 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Steel Piping with Protective Coating:
 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 3. Replace pipe having damaged PE coating with new pipe.
- C. Install fittings for changes in direction and branch connections.

3.2 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. 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. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- 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 sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.4 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 dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

- A. Aboveground natural-gas piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.

3.10 INDOOR PIPING SCHEDULE

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.

3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Valves in branch piping for single appliance shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 231123

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SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233116 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. 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.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 4 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), 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. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal

flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.

10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.7 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated:
- B. Supply Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 2 inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- C. Return Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.

- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 12.
- d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. PVC-Coated Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
3. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

- a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
- 2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

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SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

B. Related Requirements:

1. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Section 283111 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.
3. Section 283112 "Zoned (DC-Loop) Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- C. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Nailor Industries Inc.
 - 3. Pottorff.
 - 4. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.

- D. Maximum System Pressure: 2-inch wg.
- E. Frame: Hat-shaped, 0.05-inch- thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.
- F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum 0.050-inch- noncombustible, tear-resistant, neoprene with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Neoprene, mechanically locked.
- I. Blade Axles:
 - 1. Material: Nonmetallic.
 - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Aluminum.
- K. Return Spring: Adjustable tension.
- L. Bearings: synthetic pivot bushings.
- M. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20 gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 6. Screen Mounting: Rear mounted.
 - 7. Screen Material: Aluminum.
 - 8. Screen Type: Insect.
 - 9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Warming and Ventilating; a Mestek Architectural Group company.
 - b. McGill AirFlow LLC.
 - c. Nailor Industries Inc.
 - d. Pottorff.
 - e. Ruskin Company.

2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:
 - a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
 - 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. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
 2. Greenheck Fan Corporation.
 3. McGill AirFlow LLC.
 4. Nailor Industries Inc.
 5. Pottorff.

6. Ruskin Company.

B. Frames:

1. Hat shaped.
2. 0.094-inch- thick, galvanized sheet steel.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Parallel- and opposed-blade design.
3. Galvanized-steel.
4. 0.064 inch thick single skin.
5. Blade Edging: Closed-cell neoprene.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:

1. Molded synthetic.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance; a division of MESTEK, Inc.
2. American Warming and Ventilating; a Mestek Architectural Group company.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. Type: Static; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.05 thick, as indicated, and of length to suit application.
 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.024-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- K. Heat-Responsive Device: replaceable link and switch package, factory installed, 165 deg F rated.

2.7 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
 2. Greenheck Fan Corporation.
 3. McGill AirFlow LLC.
 4. Nailor Industries Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. 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.

2.8 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Hardcast, Inc.
 4. Ventfabrics, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..
 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd..
 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg F.

2.9 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flexmaster U.S.A., Inc.
 2. JP Lamborn Co.
 3. McGill AirFlow LLC.
 4. Thermaflex; a Flex-Tek Group company.
- B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 210 deg F.

4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

D. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.10 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

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 control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. 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.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 1. On both sides of duct coils.
 2. Upstream and downstream from duct filters.

3. At outdoor-air intakes and mixed-air plenums.
 4. At drain pans and seals.
 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 7. At each change in direction and at maximum 50-foot spacing.
 8. Control devices requiring inspection.
 9. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect flexible ducts to metal ducts with draw bands.
- N. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

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SECTION 233416

CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: For each product.
 - 1. Backward-inclined centrifugal fans.
 - 2. Forward-curved centrifugal fans.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include rated capacities, furnished specialties, and accessories for each fan.
 - 2. Certified fan performance curves with system operating conditions indicated.
 - 3. Certified fan sound-power ratings.
 - 4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 5. Material thickness and finishes, including color charts.
 - 6. Dampers, including housings, linkages, and operators.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AMCA Compliance: Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
- B. Capacities and Characteristics:
 - 1. As indicated on the constructions drawings and schedules.

2.2 BACKWARD-INCLINED CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Chicago Blower Corporation.
 - 2. Loren Cook Company.
 - 3. Greenheck
- B. Description:
 - 1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
 - 2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
 - 3. Factory-installed and -wired disconnect switch.
- C. Housings:
 - 1. Formed panels to make curved-scroll housings with shaped cutoff.
 - 2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - 3. Horizontally split, bolted-flange housing.
 - 4. Spun inlet cone with flange.
 - 5. Outlet flange.
- D. Backward-Inclined Wheels:

1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades, and fastened to shaft with set screws.
2. Welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.

G. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

2.3 FORWARD-CURVED CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Acme Engineering & Manufacturing Corp.
2. Loren Cook
3. Greenheck

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.

3. Factory-installed and -wired disconnect switch.

C. Housings:

1. Formed panels to make curved-scroll housings with shaped cutoff.
2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
3. Horizontally split, bolted-flange housing.
4. Spun inlet cone with flange.
5. Outlet flange.

D. Forward-Curved Wheels:

1. Black-enameled or galvanized-steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow.
2. Mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.

G. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

2.4 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install centrifugal fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Curb Support: Install roof curb on roof structure, level and secure, according to "The NRCA Roofing and Waterproofing Manual," Low-Slope Membrane Roofing Construction Details Section, Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure centrifugal fans on curbs, and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.
- F. Install units with clearances for service and maintenance.
- G. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
 - 10. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 233416

SECTION 233713.13

AIR DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular and square ceiling diffusers.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 RECTANGULAR AND SQUARE CEILING DIFFUSERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carnes Company.
2. Krueger.
3. Nailor Industries Inc.
4. Price Industries.
5. Titus.

- B. Capacities and characteristics: As indicated on the construction drawings and schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers level and plumb.

- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 233713.23

AIR REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adjustable blade face registers and grilles.
2. Fixed face registers and grilles.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 REGISTERS

A. Adjustable Blade Face Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes Company.
 - b. Krueger.
 - c. Nailor Industries Inc.
 - d. Price Industries.
 - e. Titus.
2. Capacities and characteristics: As indicated on the construction drawings and schedules.

B. Fixed Face Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes Company.

- b. Krueger.
- c. Nailor Industries Inc.
- d. Price Industries.
- e. Titus.

- 2. Capacities and characteristics: As indicated on the construction drawings and schedules.

2.2 GRILLES

A. Adjustable Blade Face Grille:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes Company.
 - b. Krueger.
 - c. Nailor Industries Inc.
 - d. Price Industries.
 - e. Titus.
- 2. Capacities and characteristics: As indicated on the construction drawings and schedules.

B. Fixed Face Grille:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes Company.
 - b. Krueger.
 - c. Nailor Industries Inc.
 - d. Price Industries.
 - e. Titus.
- 2. Capacities and characteristics: As indicated on the construction drawings and schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install registers and grilles level and plumb.
- B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

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SECTION 233723

HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof hoods.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Delegated-Design Submittal: For shop-fabricated ventilators indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of shop-fabricated ventilators.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For ventilators, accessories, and components, from manufacturer.

1.5 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.
- D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
- E. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Factory fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
- D. Fabricate supports, anchorages, and accessories required for complete assembly.

2.3 ROOF HOODS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carnes Company.
 - 2. Greenheck Fan Corporation.
 - 3. Loren Cook Company.
- B. Factory fabricated according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.
- C. Materials: Galvanized-steel sheet, minimum 0.064-inch- thick base and 0.040-inch- thick hood.
- D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Self-flashing without a cant strip, with Built-in cant mounting flange.
 - 2. Overall Height: 18 inches.
- E. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.
- F. Insect Screening: Aluminum, 18-by-16 mesh wire.
- G. Galvanized-Steel Sheet Finish:
 - 1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
 - 2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
 - 3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.
 - a. Color and Gloss: As selected by Architect from manufacturer's full rang.
- H. Capacities and Characteristics:
 - 1. As indicated on the construction drawings and schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

- B. Secure gravity ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible. Refer to Section 077200 "Roof Accessories."
- C. Install gravity ventilators with clearances for service and maintenance.
- D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 079200 "Joint Sealants" for sealants applied during installation.
- F. Label gravity ventilators according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."
- G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

END OF SECTION 233723

SECTION 234100

PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal panel filters.
2. Flat panel filters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. 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 52.2 for MERV for methods of testing and rating air-filter units.

B. Comply with NFPA 90A and NFPA 90B.

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.

2.2 METAL PANEL FILTERS

- A. Description: Factory-fabricated, self-supported, cleanable, all-metal, impingement-type, panel-type, permanent air filters with holding frames.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Airguard.
 - c. Camfil Farr.
 - 2. Subject to compliance with requirements, provide products by one of the following:
- B. Media: Four alternate layers of aluminum flat and herringbone-crimp screen.
 - 1. Nonoiled for grease removal application.
 - 2. Adhesive coating.
 - a. Adhesive: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.
 - b. Adhesive: As recommended by air-filter manufacturer and that complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Filter-Media Frame: Aluminum, hinged, and with pull and retaining handles fastened to the media.
 - 1. Drain holes.
- D. Capacities and Characteristics:
 - 1. Manufacturers standard filters or as indicated on construction drawings and schedules.

2.3 FLAT PANEL FILTERS

- A. Description: Factory-fabricated, self-supported, flat, nonpleated, panel-type, disposable air filters with holding frames.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M.
 - b. AAF International.
 - c. Camfil Farr.
 - d. Purafil, Inc.
- B. Filter Unit Class: UL 900, Class 1.
- C. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.

1. Adhesive: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.
 2. Adhesive: As recommended by air-filter manufacturer and that complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Media shall be coated with an antimicrobial agent.
 4. Metal Retainer: Upstream side and downstream side.
- D. Filter-Media Frame: Cardboard with perforated metal retainer sealed or bonded to the media.
- E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- F. Capacities and Characteristics:
1. Manufacturer's standard or as indicated on construction drawings and schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Mounting:
1. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- C. Install filters in position to prevent passage of unfiltered air.
- D. Install filter gage for each filter bank.
- E. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- F. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
- G. Coordinate filter installations with duct and air-handling-unit installations.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operate automatic roll filters to demonstrate compliance with requirements.
 - 2. Test for leakage of unfiltered air while system is operating.
- C. Air filter will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.3 CLEANING

- A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 234100

SECTION 237423.16

PACKAGED, INDIRECT-FIRED, OUTDOOR, HEATING-ONLY MAKEUP-AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes indirect-fired makeup-air units.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type and configuration of outdoor, indirect-fired makeup-air unit.
- B. Shop Drawings: For each type and configuration of outdoor, indirect-fired heating and ventilating unit.
 - 1. Include plans, elevations, sections, and mounting 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. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.
- B. Seismic Qualification Certificates: For outdoor, indirect-fired makeup-air units, accessories, and components, from manufacturer.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of indirect-fired heating and ventilating units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. REZNOR, a brand of Nortek Global HVAC.
 - 3. Sterling HVAC Products; a Mestek company.
 - 4. Trane Inc.

2.2 SYSTEM DESCRIPTION

- A. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, and indirect-fired gas burner to be installed exterior to the building.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 UNIT CASINGS

- A. General Fabrication Requirements for Casings:
 - 1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
 - 2. Casing Joints: Sheet metal screws or pop rivets, factory sealed with water-resistant sealant.
 - 3. Factory Finish for Galvanized-Steel Casings: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 - 4. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.
 - a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to air-handling-unit sections, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when air-handling-unit frame is anchored to building structure.
 - 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

- B. Configuration: Horizontal unit with horizontal discharge for roof-mounting installation.
- C. Cabinet: Galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Duct flanges at inlet and outlet. Pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
- D. Outer Casing: 0.0598-inch thick steel with heat-resistant, baked-enamel over-corrosion-resistant-treated surface in color to match fan section.
- E. Outer Casing: 0.0359-inch thick steel with heat-resistant, baked-enamel over-corrosion-resistant-treated surface in color to match fan section.
- F. Inner Casing:
 - 1. Burner Section Inner Casing: 0.0299-inch- thick steel.
 - 2. Double-wall casing with inner wall of perforated steel, for the following sections:
 - a. Blower section.
 - b. Filter section.
 - c. Mixing box.
 - d. Inlet plenum.
 - e. Discharge plenum.
 - f. Access Doors / Panels: Lift out or Piano hinged with cam-lock fasteners or Hinged with handles for burner and fan motor assemblies on both sides of unit.
 - 3. Internal Insulation: Fibrous-glass duct lining, neoprene coated, comply with ASTM C 1071, Type II, applied on burner and fan sections only.
 - a. Thickness: 1 inch.
 - b. Insulation Adhesive: Comply with ASTM C 916, Type I.
 - c. Density: 1.5 lb/cu. ft..
 - d. Mechanical Fasteners: Galvanized steel suitable for adhesive, mechanical, or welding attachment to casing without damaging liner when applied as recommended by manufacturer and without causing air leakage.
- G. Discharge Section: Trapezoidal cowls with horizontal louvers.
- H. Casing Insulation and Adhesive:
 - 1. Materials: ASTM C 1071, Type I.
 - 2. Location and Application: Factory applied with adhesive and mechanical fasteners to the internal surface of section panels downstream from, and including, the heating-coil section.
- I. Inspection and Access Panels and Access Doors: Fabricated with one percent slope in at least two planes to collect condensate from condensate-producing heat exchangers and from humidifiers, and to direct water toward drain connection; and complying with ASHRAE 62.1.

2.4 ACCESSORIES

2.5 OUTDOOR-AIR INTAKE HOOD

- A. Type: Manufacturer's standard hood or louver.
- B. Materials: Match cabinet.
- C. Bird Screen: Comply with requirements in ASHRAE 62.1.
- D. Filter: Aluminum, 1 inch, cleanable.
- E. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.6 ROOF CURBS

- A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - 1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - 2. Thickness: 1 inch.
 - 3. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
- B. Curb Height: 24 inches.

2.7 SUPPLY-AIR FAN

- A. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings. Bearing rating: L10 of 60,000 hours.
- B. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.
- C. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with spring isolators.
- D. Fan-Shaft Lubrication Lines: Extended to a location outside the casing.

2.8 AIR FILTERS

- A. Comply with NFPA 90A.
- B. Cleanable Filters: Cleanable metal mesh.
 - 1. Thickness: 2 inches.

2.9 DAMPERS

- A. Outdoor-Air Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. of damper area, at a differential pressure of 2-inch wg.
- B. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.

2.10 INDIRECT-FIRED GAS BURNER

- A. Description: Factory assembled, piped, and wired; and complying with ANSI Z21.47, "Gas-Fired Central Furnaces," and with NFPA 54, "National Fuel Gas Code."
 - 1. CSA Approval: Designed and certified by and bearing label of CSA.
 - 2. Burners: Stainless steel.
 - a. Gas Control Valve: Modulating.
 - b. Fuel: Natural gas.
 - c. Minimum Combustion Efficiency: 80 percent.
 - d. Ignition: Electronically controlled electric spark with flame sensor.
- B. Venting: Gravity vented.
- C. Venting: Power vented, with integral, motorized centrifugal fan interlocked with gas valve.
- D. Combustion-Air Intake: Separate combustion-air intake and vent terminal assembly.
- E. Heat Exchanger: Stainless steel.
- F. Heat-Exchanger Drain Pan: Stainless steel.
- G. Safety Controls:
 - 1. Vent Flow Verification: Differential pressure switch to verify open vent.
 - 2. Control Transformer: 24-V ac.
 - 3. High Limit: Thermal switch or fuse to stop burner.
 - 4. Gas Train: Regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, electronic-modulating temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 - 5. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
 - 6. Gas Manifold: Safety switches and controls complying with ANSI standards.
 - 7. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.
 - 8. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
 - 9. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.

2.11 UNIT CONTROL PANEL

- A. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.
- B. Control Panel: Surface-mounted remote panel, with engraved plastic cover and the following lights and switches:
 - 1. On-off-auto fan switch.
 - 2. Heat-vent-off switch.
 - 3. Supply-fan operation indicating light.
 - 4. Heating operation indicating light.
 - 5. Thermostat.
 - 6. Damper position potentiometer.
 - 7. Dirty-filter indicating light operated by unit-mounted differential pressure switch.
 - 8. Safety-lockout indicating light.
 - 9. Enclosure: NEMA 250, Type 1.

2.12 CONTROLS

- A. Control Devices:
 - 1. Remote Thermostat: Adjustable room thermostat with temperature readout.
 - 2. Remote Setback Thermostat: Adjustable room thermostat without temperature readout.
 - 3. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - 4. Fire-Protection Thermostats: Fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature.
 - 5. Timers: Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
 - 6. Ionization-Type Smoke Detectors: 24-V dc, nominal; self-restoring; plug-in arrangement; integral visual-indicating light; sensitivity that can be tested and adjusted in place after installation; integral addressable module; remote controllability; responsive to both visible and invisible products of combustion; self-compensating for changes in environmental conditions.
- B. Fan Control: Interlock fan to start with exhaust fan(s) to which this heating and ventilating unit is associated for makeup air.
 - 1. Smoke detectors, located in supply air, shall stop fans when the presence of smoke is detected.
- C. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.
- D. Mixed Outdoor- and Return-Air Damper Control: When fan is running, outdoor- and return-air dampers shall modulate to supply minimum outdoor air as follows:

- E. Temperature Control: Operates gas valve to maintain supply-air temperature.
 - 1. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in blower outlet.
 - 2. Timer shall select remote setback thermostat to maintain space temperature at 50 deg F.
 - 3. Burner Control: Two or four steps of control using one or two burner sections in series.
 - 4. Burner Control: 20 to 100 percent modulation of the firing rate. 10 to 100 percent with dual burner units.

2.13 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.14 CAPACITIES AND CHARACTERISTICS

- A. Capacities:
 - 1. As indicated on the construction drawings and schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- B. Unit Support: Install heating and ventilating unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction.
- C. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."
- D. Install controls and equipment shipped by manufacturer for field installation with indirect-fired heating and ventilating units.
- E. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install units on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure units to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
- F. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 1. Gas Piping: Comply with requirements in Section 231123 "Facility Natural-Gas Piping." Connect gas piping with shutoff valve and union, and with sufficient clearance for burner removal and service. Make final connections of gas piping to unit with corrugated, stainless-steel tubing flexible connectors complying with ANSI LC 1/CSA 6.26 equipment connections.
- B. Drain: Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for traps and accessories on piping connections to condensate drain pans under condensing heat exchangers. Where installing piping adjacent to heating and ventilating units, allow space for service and maintenance.
- C. Duct Connections: Connect supply ducts to indirect-fired heating and ventilating units with flexible duct connectors. Comply with requirements in Section 233300 "Air Duct Accessories" for flexible duct connectors.
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 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 tests and inspections with the assistance of a factory-authorized service representative.
- C. Units will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust initial temperature set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heating and ventilating units.

END OF SECTION 237423.16

SECTION 238239.16

PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes propeller unit heaters with hot-water coils.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include location and size of each field connection.
 - 4. Include details of anchorages and attachments to structure and to supported equipment.
 - 5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
 - 6. Indicate location and arrangement of piping valves and specialties.
 - 7. Indicate location and arrangement of integral controls.
 - 8. Wiring Diagrams: Power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which propeller unit heaters will be attached.
 - 3. Method of attaching hangers to building structure.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.

- B. Seismic Qualification Certificates: Submit certification that propeller unit heaters, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC."
- C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Trane, Modine, Reznor

2.2 DESCRIPTION

- A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 PERFORMANCE REQUIREMENTS

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.4 HOUSINGS

- A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.5 FAN AND MOTOR

- A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.
- B. Motor: Permanently lubricated. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

- A. Control Devices:
 - 1. Wall-mounted thermostat.

2.7 CAPACITIES AND CHARACTERISTICS

- A. Capacities:
 - 1. As indicated on the construction drawings and schedules.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for gas piping and electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install propeller unit heaters to comply with NFPA 90A.
- B. Install propeller unit heaters level and plumb.
- C. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers. Hanger rods and attachments to structure are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in Section 232123 "Facility Natural Gas Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to propeller unit heater's factory, gas piping package. Install the piping package if shipped loose.
- D. Comply with safety requirements in UL 1995.
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 238239.16

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 2000 V and less.
2. Connectors, splices, and terminations rated 2000 V and less.

B. Related Requirements:

1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

C. S

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer's authorized service representative.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Power Systems, Inc.
2. Service Wire Co.
3. Thomas & Betts Corporation; A Member of the ABB Group.

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. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable used in VFC circuits.
- E. Conductors: Copper complying with NEMA WC 70/ICEA S-95-658.
 - 1. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2 PV Conductor Insulation: Comply with UL 4703.
- F. Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.
 - 1. VFC Cable: Type TC-ER with oversized crosslinked polyethylene insulation, [spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire] and sunlight- and oil-resistant outer PVC jacket.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Power Systems, Inc.
 - 2. Service Wire Co.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; stranded for all wire sizes.
- B. Feeders: All feeders are to be stranded copper.
- C. Branch Circuits: All branch circuits to be stranded copper.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway Metal-clad cable, Type MC.

- C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in racewayMetal-clad cable, Type MC
- D. 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. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. 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."
- H. 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."

3.4 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 unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 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 conductors feeding the following critical equipment and services for compliance with requirements.
 - a. New Egress Lighting
 - b. New Panel Boards
 - c. Existing distribution system
 - 2. Perform each of the following visual and electrical tests:
 - a. Compare conductor and cable data with Drawings and Specifications.
 - b. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - c. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - d. Inspect compression applied connectors for correct cable match and indentation.
 - e. Inspect for correct identification.
 - f. Inspect cable jacket and condition.

- g. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - h. Continuity test on each conductor and cable.
 - i. Uniform resistance of parallel conductors.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare 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.

END OF SECTION 260519

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SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. Siemens Industry, Inc., Energy Management Division.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.

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.

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. 6AWG 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.
- C. 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 UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- 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.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

- D. 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.
- E. 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.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Requirements:

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

C. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of trapeze hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, and coordinated with each other, using input from installers of the items involved:

B. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

2.2 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, provide products by one of the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. B-line, an Eaton business.
 - c. Flex-Strut Inc.
 2. Material: Pre-galvanized steel
 3. Channel Width: 1-5/8 inches.
 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 6. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored 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 made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include 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, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) MKT Fastening, LLC.
 - 3) Simpson Strong-Tie Co., Inc.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) B-line, an Eaton business.
 - 2) Hilti, Inc.
 - 3) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch diameter.
- D. 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
- E. 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. 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.

- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

- A. 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 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Surface raceways.
4. Boxes, enclosures, and cabinets.
5. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.2 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Tube & Conduit; a part of Atkore International.
 2. Thomas & Betts Corporation; A Member of the ABB Group.
 3. Western Tube and Conduit 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. IMC: Comply with ANSI C80.6 and UL 1242.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 2. Fittings for EMT:
 - a. Material: Steel
 - b. Type: Setscrew
 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch with overlapping sleeves protecting threaded joints.
- G. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems; a part of Atkore International.
 2. RACO; Hubbell.
 3. Thomas & Betts Corporation; A Member of the ABB Group.
- 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. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-40-PVC complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business.
 - 2. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, 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.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Allied Moulded Products, Inc.
- B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Wiremold / Legrand.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated.
 - b. Wiremold / Legrand.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated.
 - 2. RACO; Hubbell.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.
 - 4. Wiremold / Legrand.
- 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. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Metal Floor Boxes:
 - 1. Material: Cast metal
 - 2. Type: Semi-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.
- G. 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.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep. Gangable boxes are allowed
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, 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. Nonmetallic Enclosures: Plastic
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- M. Cabinets
 - 1. NEMA 250, 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.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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, provide products by the following:
 - a. Quazite: Hubbell Power Systems, Inc.
 - 2. Standard: Comply with SCTE 77.
 - 3. Configuration: Designed for flush burial with integral closed 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."
 - 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

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
 - 4. 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. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - b. Mechanical rooms.
 - 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 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use setscrew steel fittings. Comply with NEMA FB 2.10.
 - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.
- G. 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 NECA 102 for aluminum conduits. 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. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. 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.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- I. 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.
- J. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- L. 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.
- M. 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.
- N. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.

2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- O. 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.
- P. 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.
- Q. 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.
 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 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 degree F of temperature change for PVC 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.
- R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed 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.
- S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

- T. 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 the box and cover plate or the supported equipment and box.
- U. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- V. Locate boxes so that cover or plate will not span different building finishes.
- W. 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.
- X. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Y. Set metal floor boxes level and flush with finished floor surface.
- Z. Set nonmetallic floor boxes level. Trim after installation to fit 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 duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. 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.
6. 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.
- E. 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 Section 078413 "Penetration Firestopping."

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 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 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.

1.2 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 waterstop 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. 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, provide products by one of 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: Stainless steel.
 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. HOLDRITE.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi 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.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch 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.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using 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.
- G. 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 waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels, including arc-flash warning labels.
8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1
- 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.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 1. Black letters on an orange field
 2. Legend: Indicate voltage and system or service type.

- B. Warning labels and signs shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

- A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. emedco.
 - c. HellermannTyton.
- B. Self-Adhesive Labels:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. emedco.
 2. Preprinted 3-mil thick, polyester flexible label with acrylic pressure-sensitive adhesive.
 3. Polyester thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
 - a. Nominal Size: 3.5-by-5-inch

2.4 TAPES AND STENCILS:

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Champion America.
 - b. HellermannTyton.
 - c. Ideal Industries, Inc.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 milsthick by 1 to 2 incheswide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. emedco.
- C. Floor Marking Tape: 2-inch-wide, 5-milpressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. Seton Identification Products.
- D. Underground-Line Warning Tape
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Ideal Industries, Inc.
 - c. Marking Services, Inc.
 2. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 3. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE" Insert drawing designation in three "Tag" subparagraphs below. Use these designations on Drawings to identify each product.

2.5 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.

3. Nominal Size: 7 by 10 inches.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Champion America.
 - b. emedco.
 - c. Marking Services, Inc.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. emedco.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:
 - a. For signs up to 20 sq. inches, minimum 1/16-inch.
 - b. For signs larger than 20 sq. inches, 1/8 inch thick.
 - c. Engraved legend with black letters on white face
 - d. Self-adhesive.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. emedco.
 - c. Marking Services, Inc.

2.6 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. HellermannTyton.
 2. Ideal Industries, Inc.
- B. General-Purpose Cable Ties: Fungus inert, 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, except where used for color-coding.
- C. 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.
- D. 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.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. 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. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- D. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- E. 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.
- F. During backfilling of trenches, install continuous underground-metallic trace warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- B. 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 industry standard colors for ungrounded feeder and branch-circuit conductors.
 - a. 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.
- C. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- D. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive vinyl labels with the conductor designation.
- E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
 - 1. Limit use of underground-line warning tape to direct-buried cables.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- H. Workspace Indication: Install floor metallic tracer marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

- I. 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.
- J. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
 - 1. Comply with NFPA 70E and ANSI Z535.4.
 - 2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- K. 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.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive label. 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 labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

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SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Indoor occupancy400 and vacancy sensors.
2. Switchbox-mounted occupancy and vacancy sensors

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Vacancy sensors.
2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Field quality-control reports.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- B. Software and firmware operational documentation.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc.
 - 2. Hubbell Building Automation, Inc.
 - 3. Lithonia Lighting; Acuity Brands Lighting, Inc.
- B. General Requirements for Sensors:
 - 1. Wall and Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
 - 2. Dual technology.
 - 3. Integrated power pack.
 - 4. Wireless connection to switch.
 - 5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 6. Operation:
 - a. Occupancy Sensor: 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.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 7. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A.
 - 8. Power: Line voltage.
 - 9. Power Pack: Dry contacts rated for 20-A LED 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.
 - 10. 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.
- 11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
- 12. Bypass Switch: Override the "on" function in case of sensor failure.
- 13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- C. Dual-Technology Type: Wall and 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 (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 - 4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 48 inches above finished floor.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc.
 - 2. Hubbell Building Automation, Inc.
 - 3. Lithonia Lighting; Acuity Brands Lighting, Inc.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using hardwired connection.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
 - 4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V, and 800-W incandescent.
- C. Wall-Switch Sensor Tag WS1:
 - 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.
4. Capable of controlling load in three-way application.
5. Voltage: Match the circuit voltage.
6. 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.
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
10. Color: White.
11. Faceplate: Color matched to switch.

2.3 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 than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- C. 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.
- D. 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.
- E. 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.

3.2 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: Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
- B. Label time switches and contactors with a unique designation.

3.4 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.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.6 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. 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 and access the system and to upgrade computer equipment if necessary.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Key interlock scheme drawing and sequence of operations.
 - 9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 INFORMATIONAL SUBMITTALS

- A. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 FIELD CONDITIONS

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- 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 PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Flush and Surface-mounted, dead-front cabinets.
1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1
 - b. Outdoor Locations: NEMA 250, Type 3R
 - c. Kitchen Areas: NEMA 250, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 2. Height: 84 inches maximum.
 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
- F. Incoming Mains Location: Convertible between top and bottom.
- G. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
 3. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.

4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
-
- I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
 - J. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 - K. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.
 - L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 PERFORMANCE REQUIREMENTS

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.3 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Eaton.
- B. Panelboards: NEMA PB 1, 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
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.
- G. Branch Overcurrent Protective Devices: Fused switches.

- H. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

- 1. External Control-Power Source: 120-V branch circuit

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1. Eaton.

- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

- C. Mains: Circuit breaker.

- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

- E. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

- 1. External Control-Power Source: 120-V branch circuit.

- F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

- G. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.

- H. All panel fronts shall be hinged type.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1. Eaton.

- B. MCCB: Comply with UL 489, with series-connected rating to meet available fault currents.

- 1. Thermal-Magnetic Circuit Breakers:

- a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

- 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

- 3. Electronic Trip Circuit Breakers:

- a. RMS sensing.
 - b. Field-replaceable rating plug or electronic trip.

- c. Digital display of settings, trip targets, and indicated metering displays.
 - d. Multi-button keypad to access programmable functions and monitored data.
 - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
 - f. Integral test jack for connection to portable test set or laptop computer.
 - g. Field-Adjustable Settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long and short time adjustments.
 - 4) Ground-fault pickup level, time delay, and I squared T response.
- 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
- 5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
- 6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
- 7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
- 8. Subfeed Circuit Breakers: Vertically mounted.
- 9. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
 - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - g. 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."
 - h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - i. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
 - 1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

2.6 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.
- D. Arc Fault Current Label: Shall have a label stating arc fault current rating and safety equipment requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to NECA 40.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box.
- F. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- H. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- I. Install filler plates in unused spaces.
- J. 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.
- K. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- 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 for low-voltage air circuit breakers 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, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Straight-blade convenience receptacles.
2. GFCI receptacles.
3. Toggle switches.
4. Wall switch sensor light switches with dual technology sensors.
5. Residential devices.
6. Wall-box dimmers.
7. Wall plates.

1.2 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Copper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 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.
- D. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
- E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596. All 120V receptacles shall be tamper resistant.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour/Legrand (Pass & Seymour).

2.3 GFCI RECEPTACLES

- A. General Description:
 - 1. 125 V, 20 A, straight blade, [feed] [non-feed]-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, 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. All 120V GFCI receptacles shall be tamper resistant.
- B. Duplex GFCI Convenience Receptacles:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Hubbell Incorporated; Wiring Device-Kellems.
- b. Leviton Manufacturing Co., Inc.
- c. Pass & Seymour/Legrand (Pass & Seymour).

2.4 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hubbell Incorporated; Wiring Device-Kellems.
 - 2) Leviton Manufacturing Co., Inc.
 - 3) Pass & Seymour/Legrand (Pass & Seymour).

2. Three Way:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hubbell Incorporated; Wiring Device-Kellems.
 - 2) Leviton Manufacturing Co., Inc.
 - 3) Pass & Seymour/Legrand (Pass & Seymour).

2.5 WALL SWITCH SENSOR LIGHT SWITCH, DUAL TECHNOLOGY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Hubbell Incorporated; Wiring Device-Kellems.
- 2. Leviton Manufacturing Co., Inc.
- 3. Pass & Seymour/Legrand (Pass & Seymour).

B. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual technology.

- 1. Connections: Provisions for connection to BAS.
- 2. Connections: Hard wired.
- 3. Connections: Wireless.
- 4. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.
- 5. Integral relay for connection to BAS.
- 6. Adjustable time delay of 10 minutes.
- 7. Able to be locked to Automatic-On mode.
- 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc

9. Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.6 RESIDENTIAL DEVICES

- A. Residential-Grade, Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour/Legrand (Pass & Seymour).
 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
- B. Weather-Resistant and Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour/Legrand (Pass & Seymour).
 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.

2.7 In determining cable category in "Description" Subparagraph below, Category 5e and Category 6 are covered by the referenced TIA/EIA standard. Use of Category 3 cabling may be permitted by authorities having 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 toggle switch with single-pole or three-way switching. Comply with UL 1472.
- C. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.8 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: Steel with white baked enamel, suitable for field painting.
 3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.9 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

B. Wall Plate Color: For plastic covers, match device color.

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. Pigtail 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 bottom. Group adjacent switches under single, multigang wall plates.

I. GFCI Receptacles: Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.2 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections

1. Tests for Convenience Receptacles:

- a. Line Voltage: Acceptable range is 105 to 132 V.
- b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
- c. Ground Impedance: Values of up to 2 ohms are acceptable.
- d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
- e. Using the test plug, verify that the device and its outlet box are securely mounted.
- f. 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.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 262726

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

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 NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Eaton.
- B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two 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. Lugs: Suitable for number, size, and conductor material.
 - 5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Eaton.
- B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two 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. Lugs: Suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Eaton.
- 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. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I^2t response.
- E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- F. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. 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.
 - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 6. 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.
 - 7. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 4.
 - 3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.2 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. Each panel board shall be labeled with AFCI rating and Arc Flash warning label with calorie rating of safety equipment.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

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SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture 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 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.2 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, arranged by designation.
- 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. Refer to drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:

B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

C. Product Certificates: For each type of luminaire.

D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five> year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Recessed Fixtures: Comply with NEMA LE 4.

- E. CRI of 80. CCT of 3000 K
- F. Rated lamp life of 35,000 hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage: 120 V ac.
 - 1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- J. Housings:
 - 1. Extruded-aluminum housing and heat sink.
 - 2. Clear and painted finish.

2.3 CYLINDER

- A. Refer to drawings for acceptable manufacturers.
- B. Minimum 1000 lumens. Minimum allowable efficacy of 80 lumens per watt.
- C. With integral mounting provisions.

2.4 DOWNLIGHT

- A. Refer to drawings for acceptable manufacturers.
- B. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.
- C. Universal mounting bracket.
- D. Integral junction box with conduit fittings.

2.5 RECESSED LINEAR

- A. Refer to drawings for acceptable manufacturers.
- B. Minimum 1,500 lumens. Minimum allowable efficacy of 85 lumens per watt.
- C. Integral junction box with conduit fittings.

2.6 STRIP LIGHT

- A. Refer to drawings for acceptable manufacturers.
- B. Minimum 750 > lumens. Minimum allowable efficacy of 80 lumens per watt.

- C. Integral junction box with conduit fittings.

2.7 SURFACE MOUNT, LINEAR

- A. Refer to drawings for acceptable manufacturers.
- B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.
- C. Integral junction box with conduit fittings.

2.8 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers, and Globes:
 - 1. Prismatic acrylic
 - 2. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded-aluminum housing and heat sink.
 - 2. Clear finish.

2.9 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.

2.10 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.
- 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
- 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 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: Sized and rated for luminaire weight.
- E. Flush-Mounted Luminaire Support: Secured to outlet box.
- F. Ceiling-Mounted Luminaire Support:
 - 1. Ceiling mount with two 5/32-inch diameter aircraft cable supports adjustable to 60 inches.
 - 2. Ceiling mount with hook mount.
- G. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
- H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.
- I. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 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.

END OF SECTION 265119

SECTION 265219 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Emergency lighting units.
 - 2. Exit signs.
 - 3. Luminaire supports.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with integral or remote emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support, arranged by designation.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 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. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, coordinated with each other, using input from installers of the items involved:
- B. Product Certificates: For each type of luminaire.

- C. Sample Warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 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. Warranty Period: Two year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for recessed luminaires.
- F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.
 - 1. Emergency Connection: Operate one lamp(s) continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than -60deg. For exceeding 104 deg F with an average value exceeding 95 deg F over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet.
 4. Test Push-Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 5. Battery: Sealed, maintenance-free, nickel-cadmium type.
 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 7. 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.
- G. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.
1. Emergency Connection: Operate one LED lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 3. Nightlight Connection: Operate lamp in a remote fixture continuously.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type.
 6. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the emergency power unit manufacturer, whichever is less.
 7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 8. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 9. 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.

2.3 EMERGENCY LIGHTING

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Emergency Lighting Unit:
 - 1. Refer to drawings for acceptable manufacturers.
 - 2. Emergency Lighting Unit: as indicated on Interior Lighting Fixture Schedule
 - 3. Operating at nominal voltage of 120 V ac
 - 4. Wall with universal junction box adaptor.
 - 5. UV stable thermoplastic housing rated for damp locations.
 - 6. Two LED lamp heads.
 - 7. Internal emergency power unit.
 - 8. External emergency power unit.

2.4 EXIT SIGNS

- A. Internally Lighted Signs:
 - 1. Refer to drawings for acceptable manufacturers.
 - 2. Operating at nominal voltage of 120 V ac
 - 3. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
 - 4. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.5 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:
 - 1. Smooth operating, free of light leakage under operating conditions.
 - 2. Designed to permit relamping without use of tools.
 - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. Prismatic acrylic
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded aluminum housing and heat sink.

2. Clear and painted finish.

E. Conduit: Rigid galvanized steel, minimum 3/4 inch in diameter.

2.6 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 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 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 and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of fixture weight.

E. Wall-Mounted Luminaire Support:

1. Attached to a minimum 20-gage backing plate attached to wall structural members
2. Do not attach fixtures directly to gypsum board.

F. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.

G. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. 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.

END OF SECTION 265219

SECTION 265619 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
- 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale and coordinated.
- B. Product Certificates: For each type of the following:
 - 1. Luminaire.
 - 2. Photoelectric relay.
- C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.6 FIELD CONDITIONS

- A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.7 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. Warranty Period: 2 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. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. Lamp base complying with ANSI C81.61.

- F. CRI of minimum 80 >. CCT of 4100 K <Insert value>.
- G. L70 lamp life of 50,000 hours.
- H. Nominal Operating Voltage: 120 V ac.
- I. Lamp Rating: Lamp marked for outdoor use.
- 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. Refer to drawings for acceptable manufacturers.
- 2. Luminaire Shape: Refer to drawings.
- 3. Mounting: Building with stainless-steel rectangular arm, 11 inches in length.
- 4. Luminaire-Mounting Height: Refer to drawings.
- 5. Distribution: Refer to drawings.

B. Canopy:

- 1. Refer to drawings for acceptable manufacturers.
- 2. Shape: Round
- 3. Dimensions: 12 inches in diameter.

2.3 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

- 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- 2. Glass: Annealed crystal glass unless otherwise indicated.
- 3. Lens Thickness: At least 0.125 inch 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.

2.4 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
 - 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
 - a. Color: Light bronze
- D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish

surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.

2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
 - b. Color: Match Architect's sample of manufacturer's standard color.
 - c. Color: As selected by Architect from manufacturer's full range.

2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
 1. Sized and rated for luminaire weight.
 2. Able to maintain luminaire position after cleaning and relamping.
 3. Support luminaires without causing deflection of finished surface.
 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- F. Wall-Mounted Luminaire Support:
 1. Attached to structural members in wall.
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- 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.

3.2 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

- A. Aim as indicated on Drawings.
- B. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
 - a. IES LM-5.
 - b. IES LM-50.
 - c. IES LM-52.
 - d. IES LM-64.
 - e. IES LM-72.
 - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.

- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

END OF SECTION 265619

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1 **SECTION 300500 - COMMON WORK RESULTS FOR ALL EXTERIOR WORK**
2
3
4

5 **PART ONE - GENERAL**
6

7 SCOPE
8

9 This section provides information common to two or more technical site work specification sections or items
10 that are of a general nature, and not included in other sections. This section applies to ALL work included as
11 part of Division 31, Division 32, and Division 33. Included are the following topics:
12

13 RELATED WORK
14

15 Applicable provisions of Division 1 govern work under this Section.
16

17 312000 – EARTHMOVING
18 312316.13 – TRENCHING
19 321123.33 – DENSE GRADED BASE
20 321216.13 – PLANT MIX ASPHALT PAVING
21 321723 – PAVEMENT MARKINGS
22 331100 – WATER UTILITY DISTRIBUTION PIPING
23 334000 – STORM DRAINAGE UTILITIES
24

25
26 REFERENCED ORGANIZATIONS
27

28 Abbreviations of organizations referenced in these specifications are as follows:
29

30	AASHTO	American Association of State Highway and Transportation Officials
31	ANSI	American National Standards Institute
32	ASTM	American Society for Testing and Materials
33	EPA	Environmental Protection Agency
34	OSHA	Occupational Safety and Health Administration
35	WDNR	State of Wisconsin Department of Natural Resources
36	WISDOT	State of Wisconsin Department of Transportation

37

38 REFERENCED DOCUMENTS
39

40 Where reference is made to WisDOT or SSHSC in this specification it shall mean the pertinent sections of
41 the Wisconsin Department of Transportation, Standard Specifications for Highway and Structure
42 Construction (SSHSC), current edition, and all supplemental and interim supplemental and interim
43 specifications.
44

45 Where reference is made to the SSSWC, it shall mean pertinent sections of the Standard Specifications for
46 Sewer and Water Construction (SSWC) in Wisconsin, current edition.
47

48 Method of measurement and basis of payment sections in referenced documents shall not apply.
49

50 QUALITY ASSURANCE
51

52 Provide materials and products as required by individual specification sections. Refer to Section GC -
53 General Conditions of the Contract regarding substitutions.
54

55 Provide quality assurance testing and reporting as required by individual specification sections.
56

57 SAFETY
58

59 Contractor is solely responsible for worksite safety.

Perform all work in accordance with applicable OSHA, state and local safety standards.

PERMITS

Unless otherwise noted in the Contract Documents, Contractor shall be responsible for obtaining and paying for all permits necessary to complete the work.

CONSTRUCTION LIMITS

Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by the Oneida Project Representative. In no case shall construction activities extend beyond state property lines or construction easements.

The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If drawings and specifications do not address restoration of specific areas, these areas will be restored to pre-construction conditions as approved by the Oneida Project Representative.

WORK BY OTHERS

Coordinate work under this project with work by Owner and other contractors on the site.

SUBMITTALS

Refer also to the General Conditions and Division 1.

Submit manufacturer's shop drawings, product data, samples, substitutions and operation and maintenance (O&M) data for approval as required by individual specification sections.

Unless otherwise noted, provide 6 copies of each submittal. Submit to project architect/engineer (A/E) unless otherwise directed by Oneida Project Representative at the Pre-Construction Meeting.

OFF SITE STORAGE

Refer to Division 1.

In general, the payments for materials stored off site will only be considered in instances where there is limited space available for storage on the site. Prior approval by the Oneida Project Representative, together with the execution of a Storage Agreement will be required.

CODES

Comply with the requirements of all applicable, local, state and federal codes.

CERTIFICATIONS AND INSPECTIONS

Refer to Section GC - General Conditions.

Obtain and pay for all required sampling, testing, inspections, and certifications except those expressly listed as provided by the A/E or other third party in the Contract Documents. Deliver originals of certificates and documents to the Oneida Project Representative within 3 days; provide copies to the A/E. Include copies of the certifications and documents in the O&M Manual.

1 AS-BUILT DRAWINGS

2
3 The Owner will provide the Contractor with a suitable set of Contract Documents on which daily records of
4 changes and deviations from contract shall be recorded.
5

6 At completion of the project, the Contractor shall submit the marked-up as-built drawings to the A/E prior to
7 final payment.
8
9

10 **PART TWO - PRODUCTS**

11
12 BARRICADES, SIGNS, AND WARNING DEVICES

13
14 Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA
15 standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).
16
17

18 **PART THREE - EXECUTION**

19
20 MAINTENANCE OF SITE AND BUILDING ACCESS/EGRESS

21
22 Unless otherwise shown or directed, maintain existing access and egress to the facility throughout
23 construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency
24 vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval
25 from the Oneida Project Representative.
26

27 CONTINUITY OF EXISTING TRAFFIC/PARKING AND TRAFFIC CONTROL

28
29 Refer also to Section GR - General Requirements.
30

31 Do not interrupt or change existing traffic, delivery, or parking without prior written approval from the
32 Oneida Project Representative. When interruption is required, coordinate schedule with the Owner to
33 minimize disruptions. When working in public right-of-way, obtain all necessary approvals and permits
34 from applicable municipalities and WISDOT.
35

36 When Contractor's activities impede or obstruct traffic flow, Contractor shall provide traffic control devices,
37 signs and flaggers in accordance with other Contract Documents and the current version of the MUTCD, or
38 as shown on the Drawings.
39

40 SURVEY AND STAKING

41
42 A/E will provide benchmarks and control points for the project as requested by the Contractor if information
43 is available and not already shown on the plans.
44

45 Contractor shall be responsible for transferring benchmarks, control points, lines and grades to the project
46 site as necessary to complete work.
47

48 UTILITY LOCATES

49
50 Contact Diggers Hotline at 1-800-242-8511 in accordance with statutory requirements. Request that non-
51 member utilities, institution owned utilities, and private utilities be located by the appropriate parties.
52 Coordinate utility locates with Owner.
53

54 Contractor shall include the costs for **ALL** underground utility locates in their bid. Locates shall include
55 excavation, backfill, survey and pictures of existing utilities within the construction limits. Survey
56 information shall include size, elevation, GPS location, materials and height and width of utility. Locates
57 shall be authorized by Oneida Project Representative.
58

1 PROTECTION AND CONTINUITY OF EXISTING UTILITIES

2
3 Verify the locations of any water, drainage, gas, storm sewer, sanitary sewer, electric,
4 telephone/communication, fuel, steam lines, chilled water or other utilities and site features which may be
5 encountered in any excavations or other sitework. All lines shall be properly underpinned and supported to
6 avoid disruption of service.

7
8 Do not interrupt or change existing utilities without prior written approval from the Oneida Project
9 Representative, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in
10 advance of outage. Notification shall be provided in writing and describe the nature and duration of outages
11 and provide the name and number of Contractor's foreman or other contact.

12
13 Any service connections encountered that are to be removed shall be cut off at the limits of the excavation
14 and capped in accordance with the requirements of applicable codes and any specifications governing such
15 removals.

16
17 PROTECTION OF EXISTING WORK AND FACILITIES

18
19 Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights,
20 utilities, and all other such facilities that may be encountered or interfered with during the progress of the
21 work. Take measures necessary to safeguard all existing work and facilities that are outside the limits of the
22 work or items that are within the construction limits but are intended to remain. Report any damage to
23 existing facilities to the Oneida Project Representative immediately. Correct all damages at no cost to
24 Owner.

25
26 STORMWATER/EXCAVATION WATER MANAGEMENT

27
28 Control grading around structures, pitch ground to prevent runoff into excavated areas.

29
30 Pits, trenches within building lines and other excavations shall be maintained free of water.

31
32 Provide trenching, pumping, other facilities as needed to control stormwater runoff and excavation water.

33
34 Notify Architect/Engineer if springs or running water are encountered in excavation; provide discharge by
35 trenches, drains, pumping to point outside of excavation. Provide information to Architect/Engineer of
36 points and areas that water will be discharged.

37
38 Implement stormwater runoff and drainage control measures to prevent damage from flooding, erosion, and
39 sedimentation to on-site and off-site areas during construction.

40
41 End of Section

SECTION 312000 -EARTHMOVING

PART ONE - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to complete earthwork required in these specifications and on the drawings. Included are the following topics:

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Related work specified elsewhere:

Section 300500 – Common Work Results For All Exterior Improvements

Section 312316.13 – Trenching

REFERENCE STANDARDS

American Society for Testing and Materials (ASTM):

D422-63	Standard Test Method for Particle Size Analysis of Soils
D4318	Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³)
D1140	Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing
D1557	Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³)
D2922	Standard Test Methods for Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)
D3017	Standard Test Method for Water Content of Soil and Rock In-Place by Nuclear Methods (Shallow Depth)
D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
D6913	Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

QUALITY ASSURANCE

The Contractor shall conduct sampling, testing, and analysis as required by this section and elsewhere in the Contract Documents either by retaining the services of an independent construction materials testing consultant or with internal certified testers. The materials testing personnel shall meet the requirements of ASTM E329.

The Contractor's construction materials testing personnel shall complete material testing as outlined in Table 312000 -1.

1

Table 312000 -1

Material	Test Required	Test/Sample Frequency
<i>Structural Fill</i>	<i>D422 Standard Test Method for Particle Size Analysis of Soils</i>	<i>1 test/500 CY placed</i>

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SUBMITTALS

Provide samples of each type of soil or aggregate proposed for use on the project. Samples shall consist of a minimum of 50 pounds of soil.

Provide copies of all material testing reports completed for the project within 48 hours of completing the individual tests. Along with each individual test result, provide a running spreadsheet of all individual test results.

QUANTITIES

Finished topsoil depth shall be as specified by the owner.

Contractor shall be solely responsible for determining all earthwork quantities based on the existing and proposed elevations provided on the drawings. Any geotechnical investigations provided by the Owner apply only to those locations that the data was collected, and may not be indicative of conditions elsewhere on the site. The Contractor is responsible for collecting any additional geotechnical or survey data he deems necessary to complete an accurate estimate of earthwork quantities.

If onsite grading, excavation and borrow operations do not provide enough suitable material for fill areas, Contractor shall coordinate and pay for excavation, transport and placement of imported material meeting the specifications of the contract documents. If excavation results in excess materials, Contractor shall coordinate and pay for loading, transport and offsite disposal of excess materials.

Contractor shall notify the Oneida Project Representative immediately if geotechnical information, existing grades, or proposed grades shown on the drawings appears to be inaccurate.

PART TWO – PRODUCTS

EARTH FILL

Use clean material consisting of inorganic soil or a mixture of inorganic soil and rock, stone or gravel. The material shall be free of topsoil, sod, stumps, wood, asphalt, concrete, debris, and other deleterious material. The maximum dimension of any material shall not exceed 2' in any direction.

GRANULAR FILL

Clean material meeting the requirements of "Grade 1" or "Grade 2" granular backfill as defined in WisDOT Section 209.2.1.

STRUCTURAL FILL

Clean material meeting the requirements of "Structure Backfill" as defined in WisDOT Section 210.2.1.

PART THREE - EXECUTION

GENERAL

Complete earthwork excavation for elevation changes, utility trenches, minor structures and building foundations in accordance with this section and the following applicable sections:

• Section 312316.13 - Trenching

TOPSOIL REMOVAL

Comply with erosion control requirements and as shown on the plan relative topsoil removal and storage.

Coordinate topsoil stockpile locations with Owner and other contractors working onsite.

Remove all topsoil from proposed locations of buildings, structures, roads, walks and other paved areas. Also, remove topsoil from proposed lawn or turf areas where the proposed elevation exceeds the existing elevation by 1' or greater, or where fill will be placed.

Stockpile reusable topsoil for use in restoration. Salvaged topsoil shall not be removed from the site without prior approval of the Oneida Project Representative.

Do not excavate, grade or work topsoil in frozen or muddy condition.

Minimize compaction of topsoil to the extent possible.

EXCAVATION

Excavate to the elevations shown on the drawings. Allow for placement of fill, base course, pavements, and topsoil as required by the drawings and other Contract Documents.

Transfer lines and grades as shown on the drawings.

Excavate areas to provide positive drainage. Contractor shall notify the Oneida Project Representative immediately if the final proposed elevations shown on the drawings do not provide drainage away from buildings, structures, roads, walks and other paved areas.

Remove excess and spoil material from the site in a timely fashion.

Do not excavate below design grades without prior authorization by the Oneida Project Representative.

PLACING AND COMPACTING MATERIAL

Place material in fill areas only after all topsoil has been removed.

Place fill to the elevations shown on drawings; allow for placement of base course, pavements and topsoil as required by the drawings and other Contract Documents.

Fill type shall be as indicated on Table 312000 -2, or as shown on the drawings.

Do not place fill on areas consisting of organic soil, debris or soft and yielding material.

Do not place fill on frozen or muddy areas.

Moisture condition subgrade as necessary to provide a firm surface prior to placing fill.

Place fill in horizontal lifts having thickness as shown on Table 312000 - 2.

Compact fill material as required by Table 312000 - 2 for given use.

Moisture condition fill material as necessary to achieve density required for given use.

Place and compact backfill so as to minimize settlement and avoid damage to walls, utility lines and other work in place. Place backfill simultaneously on both sides of free-standing structures.

It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading equipment that may be required to obtain the specified compaction. Compaction of controlled backfill by travel of grading equipment will not be considered adequate for uniform compaction. Hand guided vibratory or tamping compactors will be required whenever controlled backfill may be placed adjacent to walls, footings, and columns or in confined areas.

Table 312000 -2

Location	Required Material	Maximum Compacted Lift Thickness	Minimum Proctor Compaction	Minimum Relative Density ^(a)
Areas Beneath Footings, Floor Slabs, or Structures	Structural Fill	8"	95% Modified	70%
Footing, Foundation and Structure Backfill	Structural Fill	8"	95% Modified	70%
Areas within 10' of Existing or Proposed Building or Structure Footing or Slab	Granular Fill	12"	90% Modified	60%
Turf Areas	Earth Fill	12"	85 % Modified	50%

(a) Minimum relative density as determined by ASTM D-4253 for coarse-grained soils with less than 15% by mass passing the No. 200 (75-µm) sieve. Applicable only when minimum proctor compaction cannot be achieved.

GRADING

Grading shall include areas necessary to establish new grades as required, additional areas disturbed by construction activities, storage, equipment including all trenching, where excess fill is deposited and where cutting is required.

New grades are designed to produce desired configuration of site and do not represent a balance between cut and fill.

Excavated materials shall be disposed of by contractor at a suitable off-site location. Contractor shall be responsible for securing suitable disposal site(s) and for all off-site disposal costs.

Grades not indicated shall be uniform levels or slopes between point elevations as shown. Adjust all grades as necessary to provide positive drainage away from structures.

Grades for earthwork shall not deviate from established elevations, as shown in excess of 1 inch unless otherwise directed by Oneida Project Representative.

Do all cutting, filling, compacting fill, rough grading required to bring entire project to within respective base course elevations or 6 inches below finished topsoil elevations.

GRADING AROUND TREES

Limit excavation, filling and grading near trees or other vegetation to the extent possible. When tree roots are encountered, cut roots cleanly and squarely.

For trees within the grading limits that are to remain, install tree protection fencing as noted in the drawings.

1 SOIL STABILIZATION

2

3 Notify the Oneida Project Representative if a solid subgrade cannot be established through drying and
4 grading.

5

6 CLEAN UP

7

8 Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary
9 deposit of excavated earth. Remove all surplus material, tools and equipment.

10

11 Thoroughly clean all drainage ways, roads, parking lots, sidewalks, and paved surfaces and remove and
12 dispose of all debris and mud.

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End of Section

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SECTION 312216.15
ROADWAY SUBGRADE PREPARATION

PART 1 - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to complete pavement subgrade preparation and provide a surface ready for constructing and supporting the Dense Graded Base, as required in these specifications, on the drawings and as otherwise deemed necessary to complete the work. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference Documents
- Quality Assurance
- Permits/Fees

PART 2 - MATERIALS

- Breaker Run Aggregate
- Recycled Aggregate Products and Materials
- Geotextile Fabric

PART 3 - EXECUTION

- Preparation
- Excavation
- Preparing the Foundation
- Subgrade Approval/Proof-Rolling
- Undercutting/Excavation Below Subgrade (EBS)
- Restoration

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Related work specified elsewhere:

- Section 300500 – Common Work Results For All Exterior Improvements
- Section 033000 – Cast-In-Place Concrete
- Section 312000 – Earthmoving
- Section 312316.13 – Trenching
- Section 312500 – Erosion Control
- Section 321123.33 – Dense Graded Base

REFERENCE DOCUMENTS

Where these specifications do not cover portions of the work to be undertaken, the SSHSC in Wisconsin, current edition, shall govern the work.

QUALITY ASSURANCE

The Contractor shall conduct sampling, testing, and analysis as required by this section and elsewhere in the Contract Documents either by retaining the services of an independent construction materials testing consultant or with internal certified testers. The materials testing consultant shall meet the requirements of ASTM E329.

1 The A/E and Contactor's construction materials testing personnel shall observe all proof-rolling operations.
2 The Oneida Project Representative shall also be informed of all proof-rolling operations. Provide
3 minimum of 48 hours confirmed notice for all parties.

4 5 **PERMITS/FEES**

6
7 Contractor shall be solely responsible for obtaining all permits necessary to complete the work.
8 Contractor shall pay all fees associated with obtaining permits. These include, but are not limited
9 to permits for work within public right-of-way, land disturbance permits and building permits.

10 11 **PART 2 - MATERIALS**

12 13 **BREAKER RUN AGGREGATE**

14
15 Crushed stone, rock or gravel meeting the requirements of either Breaker Run or Select Crushed material as
16 defined in WisDOT Section 311.2 or WisDOT Section 312.2, respectively.

17 18 **RECYCLED AGGREGATE AND PAVEMENT**

19
20 Recycled or salvaged aggregate and pavement products shall be free of organics, clay, rocks greater than 3-
21 inches in least dimension and all other deleterious materials. The successful Bidder may submit
22 specifications for these materials for consideration by the A/E for use on the project as part of the submittal
23 process following contract award.

24 25 26 **PART 3 - EXECUTION**

27 28 **PREPARATION**

29
30 Review drawings and prepare work plan and schedule. Coordinate any necessary interruptions in site
31 access with Oneida Project Representative, in accordance with other specification sections.

32
33 Remove topsoil from work area. Sawcut and remove pavement from work area as indicated on the
34 drawings. Sawcuts shall be made for the full depth of pavement.

35
36 Grade roadways and parking areas to drain water away from buildings.

37 38 **EXCAVATION**

39
40 Excavate to elevations and dimensions as shown on the drawings and as necessary to complete
41 construction. Excavations shall be sufficiently deep to provide for depth of base course and pavement.

42
43 Stones over 6-inches in size shall be removed from the loosened portion of the subgrade.

44
45 Notify Oneida Project Representative if correction of unauthorized excavation or over-excavation is
46 necessary. Said excavations will be corrected by placement of Breaker Run Aggregate. Contractor will be
47 responsible for all costs associated with correcting these excavations.

48
49 Segregate the various materials excavated. Excavated material that does not meet the requirements of
50 backfill and excess excavated material, shall be removed from the site and disposed by the Contractor,
51 unless directed otherwise by other specification sections or the Oneida Project Representative.

52
53 Locate spoil piles so they do not interfere with public travel, adjacent landowners or other construction
54 activities.

1 **PREPARING THE FOUNDATION**

2
3 The subgrade shall be constructed to have a uniform stability throughout. Use of recycled and salvaged
4 aggregate and pavements shall be fully incorporated into subgrade soil. Construct the foundation to the
5 required elevation with equipment and methods adapted for the purpose. Shape and compact to provide a
6 smooth foundation, at required density, and at the proper elevation to receive the Dense Grade Base (See
7 Section 321123.33).

8
9 Compact material to minimize settlement and avoid damage to structures, pipes, utility lines and other
10 features. Hand-place and compact material as necessary.

11
12 It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading
13 equipment that may be required to obtain a subgrade that satisfies the conditions of a satisfactory subgrade
14 as defined below. Vibratory plate or tamping type walk behind compactors will be required whenever
15 backfill is placed adjacent to structures, pipes, utility lines and other features.

16
17 The prepared foundation shall be tested for compaction as defined in the paragraph entitled ‘Subgrade
18 Approval / Proof Rolling’.

19
20 **SUBGRADE APPROVAL / PROOF ROLLING**

21
22 Prior to undercutting or excavating below subgrade (EBS) or placing any Dense Grade Base (See Section
23 321123.33), contact the Oneida Project Representative to schedule inspection of the subgrade and proof
24 rolling of the subgrade. All proof rolling shall be completed in accordance with the requirements of the
25 paragraph entitled ‘Quality Assurance’ and shall meet the criteria as defined below.

26
27 To complete proof rolling, entire pavement subgrade shall be provided with a relatively smooth surface,
28 suitable for observing soil reaction during proof rolling.

29
30 Contractor shall schedule and provide a fully loaded tri-axle dump truck for proof – rolling. Loaded truck
31 shall have a minimum gross operating weight of 30 tons. Test shall be conducted with “tag” or “pusher”
32 axles retracted from the ground.

33
34 Proof rolling shall be accomplished in a series of traverses parallel to the centerline of the driveway, street,
35 or parking area. The truck shall traverse the length of the street or parking area once for each 12’ of width
36 at speeds less than 5 mph. Additional passes along the traverse shall be completed as directed by the
37 Oneida Project Representative to further define unsatisfactory subgrade.

38
39 Soft areas, yielding areas, cracked areas or areas where rolling or wave action is observed shall be
40 considered indicative of an unsatisfactory subgrade. Such areas shall be undercut as outlined in subsequent
41 subsections of this specification.

42
43 Once the subgrade has been proof-rolled and approved, protect the soils from becoming saturated, frozen,
44 or adversely altered.

45
46 **UNDERCUTTING/EXCAVATION BELOW SUBGRADE (EBS)**

47
48 Undercutting/EBS shall be completed only when directed by the Oneida Project Representative or if
49 unsatisfactory subgrade, as defined above, is observed. The Contractor shall not be compensated for any
50 unauthorized undercutting/EBS. Measure and document undercut areas and depths in consultation with
51 Oneida Project Representative.

52
53 Excavate undercut areas to the depth specified by A/E or Oneida Project Representative using equipment
54 with smooth cutting edge. Excavated undercut material that does not meet the specifications for fill needed
55 elsewhere on site shall be removed from the site and legally disposed.

Undercut areas shall be backfilled with Breaker Run (or with a combination of Breaker Run and Geotextile Fabric) in maximum of 9 inch thick lifts (compacted). Breaker Run shall be compacted to 90% Modified Proctor dry density.

Following installation and compaction of place Breaker Run material, the area shall be subject to the work defined in the paragraph entitled 'Subgrade Approval / Proof – Rolling'.

Undercutting/Excavation Below Subgrade (EBS) work shall include all materials, labor, equipment and supervision necessary to remove the soils from the Project Site considered to be poor from the proof roll and backfill and compact with Breaker Run material brought to the Project Site. The cost of the compacted Breaker Run material is incidental to the unit price item for Undercutting/Excavation Below Subgrade (EBS). If Geotextile Fabric is required and is used in combination with the Breaker Run, the unit price for the Geotextile Fabric shall include all materials, labor and equipment for installation.

RESTORATION

Roll all pavement subgrade surfaces using a smooth drum roller to promote an impervious surface and minimize percolation of water into the subgrade.

END OF SECTION

SECTION 312316.13 -TRENCHING

PART ONE - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to complete trenching for utilities and other work, as required in these specifications, on the drawings and as otherwise deemed necessary to complete the work. Included are the following topics:

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Related work specified elsewhere:

Section 300500 – Common Work Results for All Exterior Improvements

Section 312000 – Earthmoving

Section 334000 – Storm Drainage Utilities

REFERENCE STANDARDS

American Society for Testing and Materials (ASTM):

D422	Standard Test Method for Particle Size Analysis of Soils
D4318	Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils
D698	Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort
D1557	Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
D2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods
D3017	Standard Test Methods for Water Content of Soil and Rock in Place by Nuclear Methods
E329	Standard Specifications for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

QUALITY ASSURANCE

The Contractor shall conduct sampling, testing, and analysis as required by this section and elsewhere in the Contract Documents either by retaining the services of an independent construction materials testing consultant or with internal certified testers. The materials testing personnel shall meet the requirements of ASTM E329.

The Contractor's construction materials testing personnel shall complete material testing as outlined in Table 312316.13-1:

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Table 312316.13-1

Material	Test Required	Test/Sample Frequency
I.E. Granular Fill	<i>I.e. D2922-01 Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods</i>	<i>I.e. 1 test/500 lf trench</i>
Bedding/Initial Cover	D2922 Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods	1 test / 500 lf trench
Backfill Material	D2922 Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods	1 test / 500 lf trench

SUBMITTALS

Provide grainsize analysis for bedding and backfill materials.

Provide manufacturers product information for geotextile fabric.

Provide written plan(s) for Support of Existing Utilities for excavations that will expose multiple large utilities at the same time or expose utility or building structures including tunnels, box conduits, manholes and pits. Show anticipated loads and verification that proposed supports are adequate.

Provide copies of all material field testing reports completed for the project to the Oneida Project Representative and the AE within 48 hours of completing the individual tests. Along with each individual test result, provide a running spreadsheet of all individual test results.

PERMITS/FEES

Contractor shall be responsible for obtaining all permits necessary to complete trenching work. Contractor shall pay all fees associated with obtaining permits. These include, but are not limited to permits to work within right-of-way.

PART TWO – PRODUCTS

GEOTEXTILE FABRIC

Woven or non-woven fabric shall meet the requirements of the WisDOT SSSHC Section 645.2.1 and 645.2.2, Geotextile Fabric Type SAS.

CRUSHED STONE CHIPS

Pipe 18” Diameter or Less:

Clean material meeting the requirements of “3/8” Crushed Stone Chips” as defined in Section 8.43.2(a)1 of the SSSWC, except that the gradation shall be as shown herein. If used for pipe bedding, Crushed Stone Chips shall also be used for cover material.

<u>Sieve Sizes</u>	<u>Percent Passing by Weight</u>
1/2 inch	100%
3/8 inch	85 – 100%
No. 4	10 – 30%
No. 8	0 – 10%
No. 16	0 – 5%

Pipe Over 18" Diameter:

Clean material meeting the requirements of "3/4" Crushed Stone Chips" as defined in Section 8.43.2(a)2 of the SSSWC, except that the gradation shall be as shown herein. If used for pipe bedding, Crushed Stone Chips shall also be used for cover material.

<u>Sieve Sizes</u>	<u>Percent Passing by Weight</u>
1 inch	100%
3/4 inch	90 – 100%
3/8 inch	20 – 55%
No. 4	0 – 10%
No. 8	0 – 5%

CRUSHED STONE SCREENINGS

Crushed stone shall be free of organic material, concrete, asphalt and other debris. Material shall meet the requirements of "Crushed Stone Screenings" as defined in Section 8.43.2(b) of the SSSWC. If used for pipe bedding, Crushed Stone Screenings shall also be used for cover material.

<u>Sieve Sizes</u>	<u>Percent Passing by Weight</u>
1/2 inch	100%
No. 4	75 – 100%
No. 100	10 – 25%

BEDDING SAND

Sand shall meet the requirements of "Bedding Sand" as defined in Section 8.43.2(c) of the SSSWC. If used for pipe bedding, Bedding Sand shall also be used for cover material.

<u>Sieve Sizes</u>	<u>Percent Passing by Weight</u>
1 inch	100%
No. 16	45 – 80%
Material finer Than No. 200	2 – 10%

CRUSHED STONE

When crushed stone is required to affect soil stability or drainage it shall meet the gradation requirement below.

<u>Sieve Sizes</u>	<u>Percent Passing by Weight</u>
2-1/2 inch	100%
2-inch	90-100%
1-1/2 inch	35-70%
1-inch	0 – 15%
½ inch	0 – 5%

UTILITY COVER MATERIAL

Material that is to be used around and over the pipe and above the pipe bedding shall be termed utility cover material. The utility cover material for pipe shall be the same as the bedding material.

CONTROLLED BACKFILL

Granular material, meeting the following above all direct buried utilities:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
1 inch	100
3/4 inch	85 - 100
3/8 inch	50 - 80
No. 4	35 - 60
No. 10	25 - 50
No. 40	15 - 30
No. 200	5 - 15

EARTH BACKFILL

Sand/gravel non-cohesive non-expansive, free of vegetable matter, clay, rubbish, rock larger than 2 inches, boulders, concrete, paving, masonry debris, waste, frozen materials, other inorganic and deleterious materials. Existing material meeting these requirements can be reused.

FLOWABLE FILL

Controlled low strength material (CLSM) or flowable slurry fill.

Cement: Any Type, 100 lb/cu. yd & 50 lb. per cu. yd.
Aggregate: None required for slurry fill, sand for utility support.
Strength: 50 – 100 psi @ 28 days.

Fly Ash: Any class in quantity equal to cement
Density: 50 to 80 pounds per cubic foot.

Thoroughly mix in a clean ready mix truck; run mixer at mixing speed for one minute just prior to placement to insure an even mixture.

CEMENT SLURRY GROUT

Portland cement based grout having a slump of 10"-12" and the following mix proportion (per CY):

Type 1 Portland Cement	100#
Class C Fly Ash	300#
Fine Aggregate	2700#
Water	400#
Air Entraining Admixture	35 oz

Similar mix designs that are suitable for the intended use will be considered.

PART THREE - EXECUTION

PREPARATION

General Contractor shall excavate and backfill the following utilities in accordance with this section:

- Underground primary/signal vaults and duct banks
- Storm sewer
- Direct buried power and signal conduits
- Building services for underground utilities listed above.

1 Review drawings and prepare work plan and schedule. Coordinate any necessary interruptions in utility
2 service with Oneida Project Representative, in accordance with other specification sections.

3
4 Test pits, potholes or other means used to verify the location of existing underground facilities that are
5 shown on the plans are considered incidental to utility installation.

6
7 Remove topsoil from work area. Saw cut and remove pavement from the work area. Remove excavated
8 materials throughout the day. Deliver imported materials as needed throughout the day. Locate bedding,
9 backfill and spoil piles in accordance with all governing safety requirements, and do not interfere with
10 public travel, adjacent landowners or other construction activities.

11
12 The same trench may not obstruct more than one street at one time without an approved traffic control plan
13 and posted detour in accordance with Section 300500 Common Work Results for All Exterior Work.

14 CONNECTIONS TO EXISTING UTILITIES

15
16
17 Connect to existing utilities in accordance with the requirements of other pertinent specification sections.

18 DRAINAGE PROTECTION

19
20
21 Prevent surface drainage from entering utility excavations and trenches. Shape area to direct water away
22 from excavation or trench with diversions such as berms, or ditches. If drainage must cross the excavation
23 or trench, use culverts or other structure to minimize water entering the excavation or trench.

24 EXCAVATION

25
26
27 Excavate to elevations and dimensions necessary to complete construction. Excavations shall be
28 sufficiently deep to provide for bedding beneath pipes and structures and as otherwise required to complete
29 the work as shown. Excavations shall be sufficiently wide to provide for compaction equipment along the
30 side of the pipe and the sidewall of trench or inside wall of trench box, shield or shoring.

31
32 The Contractor shall provide all trench soil retention, trench boxes, sheeting and/or bracing needed to
33 protect the work, existing property, utilities, pavement, and existing improvements, and to provide safe
34 working conditions in the trench. Removal of any trench soil retention, sheeting and/or bracing from the
35 trench shall not disturb pipe bedding and cover on new or existing utilities. Sheeting and bracing shall be
36 removed unless specific permission to leave it in place is given by the Oneida Project Representative.

37
38 Contractor shall not excavate soil or impact the area of influence for structure foundations or footings.
39 Notify Oneida Project Representative and A/E immediately if foundations or footings are undermined,
40 cracked, damaged or appear unstable.

41
42 Unless noted on the drawings, the Contractor shall remove all vegetation along the full width of the
43 trench before beginning excavation. Vegetation and soil containing organic material, rock or boulders
44 larger than 6 inches in diameter shall not be used for trench backfill. Unless otherwise specified,
45 surplus material shall be the property of the Contractor, and shall be disposed of at Contractor's cost.

46
47 Trench excavation shall be backfilled when the Contractor is not working in the trench. If trench cannot be
48 backfilled due to progression of work, fence shall be installed and extend the full length of open trench on
49 all sides. Fence shall be 6-foot high, 9 gauge chain link fence fabric mounted on freestanding panels or
50 galvanized steel fence posts.

51 UNSTABLE TRENCH BOTTOM

52
53 Notify Oneida Project Representative if trench bottom consists of unstable soil, organic material,
54 debris or other undesirable material. When this condition arises, the excavation shall be carried to

such depth as directed by the A/E. Undercut backfill shall be installed and mechanically compacted to replace the excavated materials to trench bottom subgrade.

SUPPORT OF EXISTING UTILITIES

Contractor shall support all tunnels, conduits, sewers, structures, piping, wiring and cables that are exposed due to trenching and excavations. Support systems shall maintain current horizontal alignment, prevent vertical deflection and stabilize exposed piping, tunnel, duct package or conduit crossing the trench or running lengthwise in or along the trench. Support system shall be designed by an engineer licensed in the State of Wisconsin.

INSULATION FOR EXISTING UTILITIES

Contractor shall provide temporary insulation over exposed utilities to prevent damage/corrosion, wasted energy and or freezing.

BEDDING AND UTILITY COVER MATERIAL

Excavate trench to depth and alignment of proposed utility lines and grades, allowing for required amount of bedding material. Excavation shall be reasonably free of water prior to placement of bedding material. Bedding material shall be shaped to conform to bell of pipe, fittings and structures.

If unstable soils are adjacent to bedding and cover material in trench wrap bedding and utility cover material in geotextile fabric. Where sheet piling/shoring is abandoned between unstable soil and trench wall geotextile fabric may be omitted.

Bed pipes and place utility cover material for the utility and pipe type being installed in accordance with detail drawings and the depth and compaction requirements specified in table 312316.13-2 . After placing pipe, support during placement and compaction of initial utility cover material.

Compaction of utility cover material for pipe and fittings shall be accomplished using hand tools and vibratory plate or tamping type walk behind compactors.

BACKFILL AND COMPACTION

Backfilling shall not begin until excavation is cleaned of trash and debris.

After initial cover material is placed and compacted, backfill and compact trenches using the material specified in Table 312316.13 – 2. Take care to minimize settlement and avoid damage to new and existing structures, pipes, utility lines and other features during backfill placement and compaction. Place backfill simultaneously on all sides of structures. Moisture condition backfill material as necessary to achieve density required for given use. Do not place material on frozen surfaces or use frozen material.

Backfill trenches from the top of utility cover material to subgrade below pavements, base course, and topsoil as required by the drawings. Where final restoration will be delayed backfill trench to match existing grade and maintain surface drainage patterns. Wedge around structures that extend above existing grade with compacted soil or pavement to match the existing surface.

It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading equipment that may be required to obtain the specified density. Vibratory plate or tamping type walk behind compactors will be required whenever backfill is placed adjacent to structures, pipes, utility lines and other features.

Flooding or jetting of backfill material for compaction purposes is not allowed.

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Table 312316.13-2

Location	Required Material	Maximum Compacted Lift Thickness	Minimum Proctor Compaction	Minimum Relative Density ^(a)
Bedding Material Beneath Utility Structures	Crushed Stone Chips or Crushed Stone	12"	95% Modified	70%
Bedding Materials Beneath Utilities	Crushed Stone Chips, Crushed Stone Screenings, or Bedding Sand (as required in Division 33)	6"	95% Modified	70%
Utility Cover – Areas Over Bedding Materials to 12" Over Utilities	Crushed Stone Chips, Crushed Stone Screenings, or Bedding Sand (as required in Division 33)	6"	95% Modified	70%
Areas Between Top Soil and Utility Cover	Earth Backfill	12"	90% Modified	50%
Areas Between Utility Cover and Crushed Aggregate Base course Beneath Existing or Proposed Pavement (Roads, Drives, Walks)	Controlled Backfill	12"	95% Modified	60%
Areas with 10' of an Existing or Proposed Building or Structure Footing or Slab	Controlled Backfill	12"	95% Modified	60%
Turf Areas	Earth Backfill	12"	88 % Modified	50%

(a) Minimum relative density as determined by ASTM D-4253-00 for coarse-grained soils with less than 15% by mass passing the No. 200 sieve. Applicable only when minimum proctor compaction cannot be achieved.

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FLOWABLE FILL BACKFILL

If the configuration of new and existing utilities in the trench prevents the placement of backfill or the effective use of compaction equipment or if suitable backfill materials are unavailable flowable fill will be allowed for backfill as directed by the Oneida Project Representative. Flowable fill material information shall be submitted and approved by A/E prior to use. Concrete shall not be used for trench backfill.

GRADING

Grade areas disturbed during trench excavation and backfilling and adjacent areas as necessary to establish new grades shown on plans as soon as practicable after backfilling. If new grades are not shown on plans, grade areas to tie into the surrounding area without abrupt changes in elevations or slopes and provide drainage away from structures.

New grades are designed to produce desired configuration of site and do not represent a balance between cut and fill.

Grades for earthwork shall not deviate more than 1 inch from plan elevations unless otherwise directed by Oneida Project Representative.

1 GRADING AROUND TREES

2
3 Limit excavation, fill or grading near trees or other vegetation to the extent possible. No excavation,
4 trenching or backfilling shall occur within the fenced tree protection zone of existing trees without
5 authorization from Oneida Project Representative. If tree roots are encountered during trenching cut roots
6 cleanly and squarely.

7
8 CLEAN UP

9
10 Remove excess bedding, backfill and spoil material from the site as soon as possible after backfilling is
11 complete, but no later than 1 calendar day after backfilling is complete.

12
13 Thoroughly clean all drainage ways, roads, parking lots sidewalks and paved surfaces and remove and
14 dispose all debris and mud.

15
16 End of Section

**SECTION 312500
EROSION CONTROL
PART 1 - GENERAL**

SCOPE

The work under this section consists of providing all work, materials, labor, equipment, and supervision necessary to provide and construct erosion control measures necessary to protect property and the environment. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference Documents
- Submittals
- Erosion Control Plan

PART 2 - MATERIALS

- General
- Geotextile Fabric
- Temporary Ditch Barriers
- Silt Fence
- Erosion Mat
- Staples
- Riprap
- Gabion Stone
- Soil Stabilizers
- Soil Tackifiers

PART 3 - EXECUTION

- General
- Grading and Earthwork
- Drainage
- Tracking Control
- Maintenance

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Related work specified elsewhere:

- Section 024113 – Demolition
- Section 300500 – Common Work Results For All Exterior Improvements
- Section 312000 – Earthmoving
- Section 312216.15 – Roadway Subgrade Preparation
- Section 312316.13 – Trenching

Provide erosion control in accordance with the following references:

- Erosion Control Product Acceptability List (“PAL”), current version as published by the WisDOT.
- Construction Site Erosion & Sediment Control Technical Standards, current version as published by the Wisconsin Department of Natural Resources WDNR.
- Storm Water Post-Construction Technical Standards, current version as published by the WDNR.

Method of measurement and basis of payment sections in any referenced erosion control documents shall not apply to this contract.

REFERENCE DOCUMENTS

2016.36.01
35217

Erosion Control
312500-1

Wherever PAL appears in this specification, it shall mean the Wisconsin Department of Transportation, Erosion Control Product Acceptability List (PAL), current edition.

SUBMITTALS

Submit shop drawings for the following erosion control features:

- Silt Fence
- Inlet Protection

EROSION CONTROL PLAN

The A/E has prepared an erosion control plan for the project. The Contractor will provide the A/E with submittals for materials used to implement the erosion control plan, as well as any modifications to the erosion control plan that are necessary due to the Contractor's means and methods of construction.

Contractor shall comply with all the requirements of the erosion control plan, and if applicable, the Construction Site Storm Water Runoff General Permit requirements as obtained from the WRAPP. Contractor shall be responsible for completing all construction site inspection reports for the duration of the project and the Notice of Termination form required by the WDNR.

PART 2 – MATERIALS

GENERAL

Erosion mats, soil stabilizers, and tackifiers shall be listed on the Wisconsin Erosion Control Product Acceptability List (PAL) as published by the Wisconsin Department of Transportation.

When the design or contract includes permanent erosion control or stormwater control features, the contractor may employ these items in his control of erosion and stormwater during his construction activities. However, these items shall be fully cleaned, restored, and in every way fully functioning for its intended permanent use prior to acceptance of the work.

GEOTEXTILE FABRIC

Type FF geotextile fabric meeting the requirement of the PAL shall be used for inlet protection.

SILT FENCE

Fence fabric shall comply with the requirements of Standard Specifications for Highway and Structure Construction 628.2.6, in 3 foot tall rolls, with 4' tall 2" x 2" nominal cross section hardwood posts spaced a maximum of 10' o.c. Silt fence shall be Mirafi, Trevira, Amoco, CFM, or approved equal.

RIPRAP

Riprap shall be the class specified in the plan and shall conform to Standard Specifications for Highway and Structure Construction 606.2. If a class is not specified in the plan, medium riprap shall be used.

PART 3 - EXECUTION

GENERAL

1 Install erosion control measures as required by the erosion control plan and contract documents. Provide
2 additional erosion control measures as dictated by Contractor's means and methods, or by differing site
3 conditions. Notify Oneida Project Representative of additional erosion control features that are provided,
4 but not shown on the plan.
5

6 Contractor shall provide all erosion control measures necessary to protect property and the environment.
7 Perform all work in accordance with manufacturer's instruction where these specifications do not specify a
8 higher requirement.
9

10 **GRADING AND EARTHWORK**

11
12 Install all temporary or permanent erosion control measures prior to any onsite grading or land
13 disturbances.
14

15 Clear only those areas designated for the placement of improvements or earthwork before placement of the
16 final cover. Perform stripping of vegetation, grading, excavation, or other land disturbing activities in a
17 logical sequence and manner which will minimize erosion. If possible, schedule construction for times of
18 the year when erosion hazards are minimal.
19

20 Do not clear the site of topsoil, trees, and other natural ground covers before the commencement of
21 construction. Retain natural vegetation and protect until the final ground cover is placed.
22

23 Do not stockpile soil within 25 feet of any roadway, parking lot, paved area, or drainage structure or
24 channel. Provide temporary stabilization and control measures (seeding, mulching, covering, erosion
25 matting, barrier fencing) for the protection of disturbed areas and soil piles which will remain unfinished
26 for a period of more than 14 consecutive calendar days.
27

28 Remove surplus excavation materials from the site immediately after rough grading. The disposal site for
29 the surplus excavation materials shall also be subject to these erosion control requirements.
30

31 **DRAINAGE**

32
33 Minimize water runoff and retain or detain on-site whenever possible so as to promote settling of solids and
34 groundwater recharge.
35

36 Convey drainage to the nearest adequate public facility. Do not discharge water in a manner that will cause
37 erosion or sedimentation of the site or receiving facility.
38

39 Protect storm sewer inlets and catch basins in accordance with the erosion control plan, if provided. If not
40 specified, protect inlets with straw bale barriers, silt fencing, filter basket, gabion stone weepers, or other
41 equivalent methods approved by the A/E which provide the necessary erosion protection.
42

43 Divert roof drainage and runoff from all areas upslope of the site around areas to be disturbed or channel
44 them through the site in a manner that will not cause erosion.
45

46 Minimize the pumping of sediments when dewatering. Discharge to a sedimentation basin or
47 sedimentation vessel to reduce the discharge of sediments. Do not discharge water in a manner that will
48 cause erosion or sedimentation of the site or receiving facility.
49

50 **TRACKING CONTROL**

51
52 Provide each entrance to the site with a stone tracking pad. Tracking pad shall be constructed of Gabion
53 Stone or Breaker Run.
54

55 If necessary, provide a crushed aggregate paved parking area.
56

1 If applicable, wash water shall be discharged to sedimentation basins, sedimentation vessels, or other such
2 control areas. Untreated wash water shall not be discharged to storm sewers or surface water bodies.

3 4 **MAINTENANCE**

5
6 Inspect all erosion control measures within 24 hours of the end of each rainfall event that exceeds 0.25" or
7 daily during period of prolonged rainfall, or weekly during periods without rainfall. Immediately repair
8 and/or replace any and all damaged, failed, or inadequate erosion control measures.

9
10 Maintain records of all inspections and any remedial actions taken.

11
12 Maintain stockpile stabilization measures as necessary after rainfall events and heavy winds. Replace
13 tarps, re-seed, and reapply mulch, tackifiers and stabilizers as necessary.

14
15 Remove sediment from stormwater and erosion control structures, basins and vessels as necessary.

16
17 Repair or replace damaged inlet protection.

18
19 Replace or supplement stone tracking pads with additional stone when they become ineffective.

20
21 Remove any sediment reaching a public or private roadway, parking lot, sidewalk, or other paved. Do not
22 remove tracked sediments by flushing. Completely remove any accumulations not requiring immediate
23 attention at least once daily at the end of the workday.

24
25 Frequently dispose of all waste and unused construction materials in licensed solid waste or wastewater
26 facilities. Do not bury, dump, or discharge, any garbage, debris, cleaning wastes, toxic materials, or
27 hazardous materials on the site, on the land surface or in detention basins, or otherwise allow materials to
28 be carried off the site by runoff onto adjacent lands or into receiving waters or storm sewer systems.

29
30 **END OF SECTION**

SECTION 321123.33 - DENSE GRADED BASE

PART ONE - GENERAL

SCOPE

The work under this section consists of constructing a dense graded base using crushed stone or crushed gravel. The Contractor may also use crushed concrete, reclaimed asphaltic pavement, reprocessed material, or blended material. The work under this section shall provide a surface ready for constructing and supporting the Concrete or Asphalt Pavement.

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Related work specified elsewhere:

Section 033000 – Cast In Place Concrete

Section 300500 – Common Work Results For Exterior Work

Section 312216.15 – Roadway Subgrade Preparation

Section 321216.13 -- Plant Mix Asphalt Paving

REFERENCE STANDARDS

American Society for Testing and Materials (ASTM):

D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods
E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

QUALITY ASSURANCE

The Contractor shall conduct sampling, testing, and analysis as required by this section and elsewhere in the Contract Documents either by retaining the services of an independent construction materials testing consultant or with internal certified testers. The materials testing personnel shall meet the requirements of ASTM E329.

The Contractor's construction materials testing personnel shall complete material testing as outlined in Table 321123.33-1.

Table 321123.33 -1

Material	Test Required	Test/Sample Frequency
1¼-inch Base Aggregate Dense	ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort	1 test/500 CY placed
1¼-inch Base Aggregate Dense	ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods	1 test/500 CY placed

SUBMITTALS

Provide copies of all material testing reports completed for the project within 48 hours of completing the individual tests. Along with each individual test result, provide a running spreadsheet of all individual test results.

PART TWO - PRODUCTS

DENSE GRADED BASE

Use dense graded base (*1 1/4-inch*). Provide aggregate conforming to WisDOT Section 301.2 of the SSHSC for crushed stone, crushed gravel, crushed concrete, reclaimed asphaltic pavement, reprocessed material or blended material. Material gradations shall conform to WisDOT Section 305.2.2 of the SSHSC unless specified elsewhere in the contract documents.

PART THREE - EXECUTION

CONSTRUCTION

Preparing the Foundation

Refer to Section 312216.15 – Roadway Subgrade Preparation.

Pulverized and Re-laid Pavement

Pulverize the existing asphaltic pavement full depth according to WisDOT Section 325.3 of the SSHSC.

Placing Dense Graded Base Aggregate

Construct Dense Graded Base as specified in WisDOT Section 305.3 of the SSHSC. Compact each base layer, including shoulder foreslopes, with equipment specified in WisDOT Section 301.3.1 of the SSHSC.

Use standard compaction conforming to WisDOT Section 301.3.4.2 of the SSHSC, unless otherwise specified herein. Final shaping of shoulder foreslopes does not require compaction.

Construct the base to the width and section the drawings show. Shape, and compact the base surface to within 0.04 feet of the drawing elevation.

Ensure there is adequate moisture in the aggregate during placing, shaping, and compacting to prevent segregation and achieve adequate compaction. Moisture condition dense graded base as necessary to achieve required density as determined by ASTM D1557.

Excavation shall be reasonably free of water prior to placement of dense graded base. Do not place dense graded base on frozen surfaces or use frozen material.

Maintain the base until paving over it, or until the Oneida Oneida Project Representative accepts the work, if paving is not part of the contract.

Placing Dense Graded Base Shoulders

If the roadway is closed to through traffic during construction, construct the aggregate shoulders before opening the road to traffic.

If the roadway remains open to through traffic during construction and a 2-inch or more drop-off at the pavement edge exists; eliminate the drop-off within 48 hours after completing the asphalt or concrete work. Unless the special provisions specify otherwise, provide aggregate shoulder material compacted to a 4:1 or flatter cross slope from the surface of the pavement edge.

Provide and maintain signing and other traffic protection and control devices, as specified in WisDOT Section 643 of the SSHSC, until completing shoulder construction to the required cross-section and flush with the asphaltic pavement or surfacing.

Construct aggregate shoulders to the elevations and typical sections the drawings show, except for minor modifications needed to conform to other work. Use equipment that does not damage or mar the pavement surface, curbs, or appurtenances.

Place aggregate directly on the shoulder area between the pavement edge and the outer shoulder limits. Recover uncontaminated material deposited outside the limits and place within the limits.

Do not deposit aggregate on the pavement during placement, unless the A/E specifically allows. Do not leave aggregate on the pavement overnight. After placing the shoulder aggregate, keep the pavement surface free of loose aggregate.

COMPACTION

Compacting Dense Graded Base Aggregate

If using a pneumatic roller, do not exceed a compacted thickness of 6 inches per layer. For the first layer placed over a loose sandy subgrade, the Contractor may, with A/E approval, increase the compacted layer thickness to 8 inches. If using a vibratory roller, do not exceed a compacted thickness of 8 inches per layer.

The material shall be compacted to meet the following:

Test Method to determine maximum density and moisture	ASTM D1557
Relative compaction relative to the optimum	95%
Moisture content relative to the optimum	-2% to +2%

The compacted material shall be tested for in-place field density in accordance with this Section, Part I, Quality Assurance.

CLEANUP

After the project is completed, thoroughly clean up all debris which may have accumulated during the placement of dense graded base and breaker run, if placed. All storm sewer manholes, inlets, and trench drains within the project area shall be inspected in the presence of the Oneida Project Representation, the Owner Agency, and the A/E to confirm there is no accumulated debris. The Contractor shall ensure the manholes, inlets, and trench drains are free of water and debris prior to inspection by the parties noted above. Any accumulated debris in the manholes, inlets, and trench drains shall be removed and properly disposed of by the Contractor.

Replace or repair as required, all surfaces and/or landscape features damaged or disturbed under this item of work.

End of Section

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1
2
3
4
5 **SECTION 321216.13 - PLANT MIX ASPHALT PAVING**

6 **PART ONE - GENERAL**

7 **SCOPE**

8
9 The work under this section shall consist of providing all work, materials, labor, equipment, and supervision
10 necessary to provide and construct the paving and surfacing as provided for in these specifications and on the
11 drawings. Included are the following topics:
12

13 **RELATED WORK**

14
15 Applicable provisions of Division 1 govern work under this Section.
16

17 Related Work Specified Elsewhere:
18 Section 300500 – Common Work Results For All Exterior Improvements
19 Section 312216.15 – Roadway Subgrade Preparation
20 Section 321123.33 – Dense Graded Base
21

22 **PART TWO - PRODUCTS**

23
24 **RECYCLED PRODUCTS AND MATERIALS**

25
26 The Owner encourages the use of recycled materials and products containing recycled materials. Bidders
27 may submit specifications for recycled materials and products containing recycled materials for consideration
28 by the Owner for use on the project as part of the submittal process following the contract award.
29

30 **HOT MIX ASPHALTIC (HMA) PAVEMENT**

31
32 Provide HMA pavement 3 LT 58-28 S Lower and 4 LT 58-28 S Upper conforming to the requirements of
33 WisDOT SSHSC Section 450 and Section 460. Utilize the same material type throughout the paving
34 operation unless noted elsewhere on the drawings. Ensure all materials provided under this section conform
35 to the requirements of WisDOT SSHSC, Section 455 and as revised in any current Supplemental
36 Specifications.
37

38 **TACK COAT**

39
40 Apply tack coat at a rate of 0.05 gallons per square yard to the lower layer(s) of HMA pavement surface prior
41 to placing surface layer of HMA pavement. Tack coat shall require a minimum asphalt content of 50% and
42 meet all other requirements of the WisDOT SSHSC Section 455.
43

44 **PART THREE - EXECUTION**

45
46 **HOT MIX ASPHALT (HMA) PAVEMENT**

47
48 Complete all work under this section to WisDOT SSHSC, Section 450 and Section 460. Provide HMA layer
49 thicknesses as shown on the drawings. The minimum thickness of the HMA binder layer shall not be less
50 than 2-1/4 inches (19 mm nominal aggregate size). The minimum thickness of the HMA surface layer shall
51 not be less than 1-3/4 inches (12.5 mm nominal aggregate size).
52

53 **PAVEMENT REPAIRS**

54
55 Sawcut all pavement surfaces to neat and straight lines at the limits of removal by a two-step method. Limit
56 the initial pavement removal to the immediate area of the proposed work. Full depth sawcutting is not
57 required for this phase of removal. After the work is completed, make a full depth sawcut to neat and

1 straight lines outside the widest point of pavement disruption. Sawcut the lines of the repair parallel to
2 existing joints, or parallel to or perpendicular to pavement edges so as to form a neat patch. Carefully
3 remove all remaining pavement within the sawcut area to the lines of the sawcut. Do not disturb the existing
4 base materials between the area disturbed by the work and the sawcut line by the sawcutting, pavement
5 removal, or pavement replacement processes.

6
7 Remove all walks, curbs, and other jointed paving by sawcutting at the nearest joint beyond the limits of
8 removal.

9
10 Adjust all inlets, manholes, catch basins, valve boxes, and other such castings to match new finished grade as
11 incidental work.

12
13 Clean and fill all major structural cracks (not alligatored areas) with crack filler conforming to ASTM D-
14 3405 prior to placing new HMA pavement overlay. Place tack coat on all surfaces in accordance with
15 WisDOT SSHSC Section 455. Apply emulsified asphalt tack coat at the rate of 0.05 gallons per square yard
16 to the existing asphalt surface.

17
18 Place HMA binder course in all areas undergoing removal and replacement and in areas receiving new HMA
19 surface course. Remove existing gravel as necessary to allow placement of binder course in lift thicknesses
20 as shown on the drawings.

21
22 Place HMA surface course on all roadway, parking lots, service drives, and loading dock areas as designated
23 on the drawings.

24
25 End of Section

SECTION 321723 - PAVEMENT MARKINGS

PART ONE - GENERAL

SCOPE

The work under this section consists of providing all work, materials, labor, equipment, and supervision necessary to provide and install pavement markings as provided for in these specifications and on the drawings. Included are the following topics:

RELATED WORK

Applicable provisions of Division 01 govern work under this Section.

Related Work Specified Elsewhere:
Section 300500 – Common Work Results For All Exterior Improvements

SUBMITTALS

Submit the manufacturer specifications for each pavement marking. The submittal for each material shall include the following at a minimum:

- Pavement Marking Material and Manufacturer
- Color and Batch Number
- Date Manufactured (Material more than one year old will not be accepted)
- Manufacturer Name and Address.

PART TWO - PRODUCTS

PAVEMENT MARKINGS

Furnish paint pavement markings conforming to WisDOT Section 646.2 as specified in the drawings.

PART THREE - EXECUTION

PAVEMENT MARKINGS

Prepare surface to receive markings and install them in accordance with WisDOT Section 646.3.

Apply pavement markings at the locations and to the dimensions and colors as shown on the drawings. If not otherwise specified, marking lines shall be yellow and have a minimum width of 4 inches.

Apply pavement markings at a rate per the manufacturers recommended application rate based on the temperature and surface material.

End of Section

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1 **SECTION 331100 - WATER UTILITY DISTRIBUTION PIPING**
2
3
4

5 **PART ONE - GENERAL**
6

7 **SCOPE**
8

9 The work under this section shall consist of providing all work, materials, labor, equipment, and supervision
10 necessary to provide water distribution system components and other work, as required in these
11 specifications, on the drawings and as otherwise deemed necessary to complete the work. The limits of the
12 work, including the responsible party for testing purposes, shall be clearly defined on the Drawings.
13

14 **RELATED WORK**
15

16 Applicable provisions of Division I govern work under this section.
17

18 Related work specified elsewhere:

19 Section 300500 – Common Work Results for All Exterior Work

20 Section 312316.13 – Trenching

21 Section 312500 – Erosion Control
22

23 **REFERENCE DOCUMENTS**
24

25 Where reference is made to the “SSSWC”, it shall mean pertinent sections of the Standard Specifications for
26 Sewer and Water Construction in Wisconsin, current edition. Method of measurement and basis of payment
27 sections in referenced documents shall not apply.
28

29 Where these specifications do not cover portions of the work to be undertaken, the Standard Specifications
30 for Sewer and Water Construction in Wisconsin, current edition, shall govern the work.
31

32 **REFERENCE STANDARDS**
33

34 American Society for Testing and Materials (ASTM):

35 B88	Standard Specifications for Seamless Copper Water Tube
36 F477	Standard Specifications for Elastomeric Gaskets for Joining Plastic Pipe
37 D3139	Standard Specifications for Joints for Plastic Pressure Pipes Using
38	Flexible Elastomeric Seals
39 D3350	Standard Specifications for Polyethylene Plastic Pipe and Fittings
40	Materials

41
42 American Water Works Association (AWWA):

43 C502	Dry Barrel Fire Hydrants
44 C504	Rubber-Seated Butterfly Valves
45 C509	Resilient-Seated Gate Valves for Water Supply Service
46 C515	Reduced Wall, Resilient Seated Gate Valves for Water Supply Service
47 C550	Protective Epoxy Interior Coatings for Valves and Hydrants
48 C800	Underground Service Line Valves and Fittings
49 C900	Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings for
50	Water Distribution (4”-12”)
51	
52 C905	Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings for
53	Water Distribution (14”-48”)
54 C906	Polyethylene Pressure Pipe, and Fabricated Fittings for Water
55	Distribution (4”-63”)
56 C104/ANSI A21.4	Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for
57	Water

C105/ANSI A21.5	Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
C111/ANSI A21.11	Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
C151/ANSI A21.51	Standard for Ductile Iron Pipe, Centrifugally Cast
C153/ANSI A21.53	Standard for Ductile Iron Compact Fittings

SUBMITTALS

Provide manufacturers product information (cut sheets) and O&M information for watermain materials including:

- Pipe
- Fittings
- Valves
- Joint Restraint Materials

Provide copies of all pressure and electric continuity testing procedures and results for the project to the Oneida Oneida Project Representative and the AE within 48 hours of completing the individual tests.

Provide reports that document safe sample collection procedures and results.

CONTINUITY OF EXISTING WATER DISTRIBUTION SYSTEM

Provide a construction schedule to Oneida Oneida Project Representative, municipal water utility (if applicable) and local fire department (if applicable) for review and approval prior to starting construction. Schedule shall indicate the date and time of all required water supply interruptions.

Do not interrupt existing water supply without approval from Oneida Oneida Project Representative, municipal water utility, and local fire department.

Once approved, notify all distribution system users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing and describe the nature and duration of outages, and provide the name and number of Contractor's foreman or other contact.

PROVISIONS FOR FUTURE WORK

Construct watermain system in a manner that will facilitate future extension or connection.

Unless otherwise shown on the drawings, provide valves on "dead end" mains that will allow dry connection to the watermain system. Terminate "dead end" mains with full length of pipe beyond the valve, and a bell end with restrained plug.

AS-BUILT DRAWINGS

Show the actual locations of watermain and services, valves and hydrants on drawings and show changes to proposed watermain size, alignment, or grades. Show the actual locations, sizes and types of underground utilities and other features encountered during construction.

PART TWO - PRODUCTS

DUCTILE IRON WATERMAIN

Ductile watermain shall be Class 52, ANSI/AWWA C151/A21.51centrifugally cast, cement mortar lined meeting the requirements of ANSI/AWWA C104/A21.4.

Ductile iron watermain joints shall be rubber gasket push-on joint or mechanical joint meeting the requirements of ANSI/AWWA C111/A21.11.

Pipe shall be provided with conductive bonding straps to provide electrical continuity.

Pipe shall be manufactured in the United States.

PVC WATERMAIN

Polyvinyl chloride pipe shall have a dimension ratio (DR) of 18 or less and conform to the requirements of AWWA C900 (4"-12") or AWWA C905 (14"-48"). Pipe shall meet applicable NSF standards for use in a potable water distribution system.

PVC watermain joints shall be rubber gasket push-on joint conforming to ASTM D 3139, using a gasket that conforms to ASTM F477.

DUCTILE IRON WATERMAIN FITTINGS

Fittings shall be ductile iron cement mortar lined mechanical joint compact style fittings meeting the requirements of ANSI/AWWA C153/A21.53.

Fittings shall be manufactured in the United States.

VALVES

Resilient Wedge Gate Valve

Resilient seated wedge gate valve meeting the requirements of AWWA C509 and C515. Body, bonnet and gate shall be constructed of ductile iron. Bolts shall be stainless steel.

Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Symmetrical wedge shall be completely encapsulated with resilient material.

Valve stem shall be non-rising, low-zinc (zinc content not to exceed 6%) bronze. Valve stem shall have an integral thrust collar. Thrust collar bearings shall be designed to withstand maximum torque without distortion.

Stem seal shall be so designed that the O – ring above the stem collar can be replaced while the valve is under pressure and in the fully open position.

Valve shall be left opening and be provided with standard 2" square operating nut.

Valve shall be provided with mechanical joint connections. Mechanical joint ends shall conform to AWWA C509 and shall be furnished complete with all mechanical joint accessories including approved M.J. bolts and nuts. Glands shall be full body gray iron or ductile iron. Mechanical joint bells, glands and rubber gaskets shall be in accordance with AWWA C111.

Mueller, Kennedy, US Pipe, American Flow Control, Clow, or approved equal.

Tapping Valve

Resilient seated wedge gate tapping valve having 100% port, and meeting the requirements of AWWA C509 and C515. Body, bonnet and gate shall be constructed of ductile iron. Bolts shall be stainless steel.

Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Symmetrical wedge shall be completely encapsulated with resilient material.

Valve stem shall be non-rising bronze. Stem collar shall be provided with thrust bearings that are protected by upper and lower O-ring seals both above and below.

Valve shall be left opening and be provided with standard 2" square operating nut.

Valve shall be provided with flange connection on inlet side of valve and mechanical joint connections on outlet side of valve. Mechanical joint end shall conform to AWWA C509 and shall be furnished complete with all mechanical joint accessories including approved M.J. bolts and nuts. Glands shall be full body gray iron or ductile iron. Mechanical joint bells, glands and rubber gaskets shall be in accordance with AWWA C111.

Provide suitable companion tapping sleeve.

Mueller, US Pipe, American Flow Control, Clow, or approved equal.

VALVE BOXES

Gate/Butterfly Valve Boxes

Valve boxes shall be screw type and shall consist of a base, middle section, top section with cover and intermediate extension sections. The top section shall be designed to thread onto the middle section so that the unit can be adjusted to a variable length. The top section shall be designed to receive a circular drop cover.

The valve box and component parts shall be cast iron in accordance with ASTM-A48 class 20, 30, 35, or approved equal.

Boxes shall be 5-1/4" with stay-put "WATER" cover.

The cast iron valve box and components shall be free from blowholes, cold shots, shrinkage defects, cracks or other injurious defects and shall have a normal smooth casting finish.

All cast iron valve boxes and components shall be thoroughly coated with asphaltic pitch varnish or approved equal.

Provide valve box extensions as necessary to accommodate depth of cover shown on drawings, or 6.5-foot minimum.

Valve boxes shall be Bingham & Taylor, East Jordan Iron Works, Tyler, or approved equal.

JOINT RESTRAINTS

Retainer Glands for Ductile Iron Pipe

Ductile iron wedge action retainer glands designed for use with ductile iron pipe.

Glands shall be constructed of. Restraint shall be provided by a minimum of three wedges that are tightened onto the exterior of the pipe using a threaded, torque limiting mechanism.

Glands shall be tested to provide restraint at 250 psi operating pressure.

EBAA Iron, Mueller AquaGrip, Romac Romagrip, or approved equal.

Retainer Glands for PVC Pipe

Wedge action retainer glands designed for use with PVC pipe.

Glands shall be constructed of ductile iron. Restraint shall be provided by a minimum of four wedges that are tightened onto the exterior of the pipe using a threaded, torque limiting mechanism.

Glands shall be tested to provide restraint at 200 psi operating pressure.

1 Retainer glands shall be MEGA-LUG by EBAA Iron, or approved equal.

2
3 EBAA Iron, Mueller AquaGrip, Romac Romagrip, or approved equal..

4
5 **POLYETHYLENE ENCASEMENT BAG**

6
7 8-mil polyethylene encasement bag meeting the requirements of ANSI/AWWA C105/A21.5, Class "C"
8 black.

9
10 **BOARD INSULATION**

11
12 Insulation shall be rigid, closed-cell extruded polystyrene insulation suitable for buried installation.
13 Individual boards shall have minimum dimensions of 8'x4'x2".

14
15 Owens Corning, Dow Styrofoam, or approved equal.

16
17 **TRACER WIRE**

18
19 Tracer wire shall be #10 solid copper wire with insulated jacket. Tracer wire insulation color for non-
20 metallic, potable water pipe shall be blue. Tracer wire insulation color for non-metallic, non-potable water
21 pipe shall be purple.

22
23 **LOCATOR TAPE**

24
25 Tape shall be detectable metallic locator tape, specifically manufactured for marking utilities with a
26 minimum width of 6 inches and detectable at a depth of 18".

27
28 Tape for potable water shall be marked "WATER" and blue colored. Tape for non-potable water shall be
29 marked "NON-POTABLE WATER" and purple colored.

30
31 **CHLORINE**

32
33 Chlorine disinfectant shall be calcium hypochlorite tablets or granules. Calcium hypochlorite product shall
34 meet requirements for AWWA C651 – Standard for Disinfecting Water Mains - latest revision.
35 Arch "HTH", or approved equal.

36
37 **PIPE JOINT LUBRICANT**

38
39 Petroleum free pipe lubricant formulated for use with potable water systems. Product shall meet the
40 requirements of ANSI/AWWA C111/A21.11 - latest revision.

41
42
43 **PART THREE - EXECUTION**

44
45 **GENERAL**

46
47 Complete exploratory excavations at utility crossings as shown on the drawings and as necessary to complete
48 the work.

49
50 Maintain clearances between watermains and existing or proposed sewer lines as follows:

- 51 • 8' horizontal separation (measured center to center) between watermains and existing or proposed
- 52 sanitary or storm sewers.
- 53 • 12" vertical separation (measured from outsides of pipes) where watermains cross over sanitary or storm
- 54 sewers.
- 55 • 18" vertical separation (measured from outsides of pipes) where watermains cross under sanitary or
- 56 storm sewers.
- 57

1 Notify the A/E and Oneida Project Representative of utility conflicts as soon as they are encountered.

2
3 Store and handle pipe in accordance with manufacturers' recommendations. Keep pipes clean of soil, debris
4 and animals.

5
6 Watermain construction shall be completed in a manner that minimizes interruptions to existing services.

7 8 CONNECTIONS TO EXISTING WATERMAINS/TAPPING

9
10 Provide tapping sleeves, valves, cutting-in sleeves and other materials specifically manufactured for use with
11 the type of pipe to which the connection is being made.

12
13 Notify the Oneida Project Representative if the proposed point of connection is located within 4' of an
14 existing joint.

15
16 Connections shall be made at existing pipe stubs, valves or other fittings.

17
18 At connections to existing mains, locate the new valve as close to the existing main as possible. Swab the
19 interior surfaces of all pipe, fittings, valves that will be exposed to the existing system. Swab solution shall
20 consist of a 5% (by weight) solution of calcium hypochlorite.

21 22 BEDDING /UTILITY COVER

23
24 Provide bedding and utility cover in accordance with the applicable requirements of Section 312316.13 –
25 Trenching.

26
27 Watermain and water service piping shall be provided with 6" of bedding material and 12" of utility cover
28 material (both measured at the bell of the pipe).

29
30 Bedding and cover material for various types of pipe shall consist of the following:

- 31 • Ductile Iron Watermain: Bedding sand or crushed stone screenings.
- 32 • PVC Watermain: Crushed stone bedding.

33 34 LAYING WATERMAIN

35
36 Install pipe in accordance with the SSSWC and ASTM specifications that pertain to the specified type of pipe
37 material and the installation situation.

38
39 Provide a minimum of 6.5' of cover over watermain, unless otherwise shown on the drawings or directed by
40 the Oneida Project Representative. For watermain with less than 6.5' of cover, provide insulation as shown
41 on the drawings, or as directed by the Oneida Project Representative.

42
43 Lay watermain at uniform grades between deflection points shown on the drawings; do not install
44 watermain with intermediate high points.

45
46 Unless otherwise shown or approved by the Oneida Project Representative, lay pipe with bell end facing the
47 direction of pipe laying.

48
49 For ductile iron watermain, place polyethylene encasement bag on watermain prior to lowering into trench.
50 Once pipe is joined, pull bag over entire length of pipe, overlap joint at adjacent pipe and secure using
51 "Duct" tape or other approved method.

52
53 Prepare pipe bell and gasket in accordance with manufacturers requirements. Lubricate bell and/or pipe with
54 AWWA/NSF approved lubricant.

55
56 Push pipe home in accordance with manufacturer's recommendations regarding tools and methods.

Pipe joint deflection shall not exceed manufacturer's requirements.

For ductile iron pipe, connect bonding straps or lugs to provide electrical continuity along entire watermain. Provide exothermic weld to attach new bonding straps, when existing straps are missing or damaged. Follow manufacturer's requirements for exothermic welding procedures.

Locate the geographic location of all dead end watermains and services and note actual location on As-Built Drawings.

Disinfect pipe by placing calcium hypochlorite in each section of pipe as pipe laying progresses. Provide dosage as indicated on Table 331100-1.

Watermain Nominal Diameter (inches)	Dose Calcium Hypochlorite* (oz./length pipe)
4-6	1
8	3
10	5
12	7

* Granular/tablet calcium hypochlorite with 68% (weight) available chlorine
Table 331100-1

When required, provide board insulation in the thickness and width shown on the drawings. Unless otherwise shown, insulation shall be provided at a minimum thickness of 2 inches.

Install insulation on compacted initial cover material 6 inches above the top of pipe. Stagger joints when placing multiple layers of insulation.

Provide insulation with a minimum of 1 foot of utility cover material. Place backfill material in manner that does not damage insulation; replace damaged insulation.

TRACER WIRE

Provide tracer wire for buried non-metallic water piping. Tracer wire shall be installed directly above the top of pipe and within six inches of the pipe.

Splices in tracer wire shall be made with split-bolt or compression-type connectors.

Access points are required every 400 feet. At access points the tracer wire shall be brought to grade in valve boxes, utility structures or other covered access devices.

LOCATOR TAPE

Install locator tape directly above new non-metallic sanitary sewer pipe approximately 15 inches below finished grade. Bring tape to surface and terminate in valve box or other structure.

FITTINGS AND VALVES

Install fittings and valves at locations shown on the drawings.

Unless otherwise shown, provide restrained mechanical joint connections. Install materials in accordance with manufacturer's recommendations.

Maintain electrical continuity through all fittings and valves. Provide and install suitable jumper cables for epoxy coated valves.

1 Place hydrants and valves on 4"x8"x16" solid concrete masonry units set on compacted soil.

2
3 Install joint restraints in accordance with the requirements of this section.

4
5 Install valve box so that bonnet rests on compacted initial backfill material at the same elevation as the top of
6 the valve stuffing box. Center the valve box over the valve nut.

7
8 Install valve box plumb and level, backfilling evenly. Extend valve box to proposed final grade; provide
9 valve box extensions as necessary. Valve boxes that shift during backfilling or restoration shall be excavated
10 and re-set.

11
12 Mark all valve boxes with a steel "U" fence post to protect them from damage.

13 14 JOINT RESTRAINT

15
16 Unless otherwise noted, all fittings, valves and hydrants shall be installed with restrained joints. Joint
17 restraints shall be used on the adjacent full length (or more lengths as shown on the drawings) of pipe on all
18 sides of fittings. Additionally, branch runs of pipe shall be installed with restrained joints beginning at the
19 fitting at the main to the first valve.

20
21 Joint restraint shall be provided using retainer glands.

22
23 Install all joint restraint products in accordance with manufacturer's recommendations and drawings.

24 25 FILLING WATERMAIN

26
27 Fill watermain after main has been installed and completely backfilled.

28
29 Fill main slowly to limit entrapped air and evenly distribute calcium hypochlorite. Open all hydrants
30 completely to allow air to escape and monitor filling.

31
32 Once main is full, allow a minimum of 48 hours of time for disinfection to occur before flushing.

33 34 PRESSURE TESTING

35
36 Pressure test all watermain and copper water services.

37
38 Provide all valves, fittings, joint restraints, hoses, compressors, water and power supply as necessary to
39 complete pressure testing. Utilize testing apparatus that is fabricated specifically for testing watermain.
40 Calibrate pressure gauges as necessary.

41
42 Flush main as necessary to remove air prior to testing. Comply with the requirements of this section with
43 respect to flushing.

44
45 For longer installations or installations consisting of watermain and copper water service, the Contractor may
46 elect to pressure test the system in short segments.

47
48 All pressure testing shall be conducted in the presence of the Oneida Project Representative. Provide
49 minimum of 48 hours advanced notice of testing.

50
51 Conduct a combined pressure/leakage test for 1 hour at a pressure equal to 150% of system normal operating
52 pressure (as measured at the lowest point in the system), or a minimum pressure of 150 psig.

53
54 When conducting test, pressure test equipment shall be set-up as close to the highest point in the line as
55 possible.

1 Make-up water for the test shall be clean potable water supplemented with ½ oz of dry calcium hypochlorite
2 per 35 gallons of water.

3
4 Leakage for test shall not exceed gallons per hour as allowed by the attached formula:

5
6
$$G=(ND\sqrt{P})/7400$$

7
8 Where: G= Allowable leakage (gallons per hour of test)

9 N=Number of joints under test

10 D=Nominal diameter of main (inches)

11 P=Average pressure during test (psig)

12
13 Allowable leakage for high density polyethylene pipe shall be zero.

14
15 Record and document pressure test by recording the following information:

- 16 • Date of test
17 • Section tested
18 • Diameter and length of main under test
19 • Number of fittings, valves hydrants, etc.
20 • Results of test including test length, pressure, actual water loss
21 • Calculation of allowable leakage
22 • If a failed test, describe actions taken to eliminate leaks and results of re-testing
23

24 Submit reports documenting pressure testing.

25 ELECTRIC CONTINUITY TESTING

26
27 Conduct electric continuity test on all ductile iron watermain and copper water services.

28
29 The electric continuity test shall be performed using a multi-meter to verify electrical continuity of the
30 watermain system.

31
32 The Contractor shall furnish all labor and equipment necessary to conduct the electric continuity test.

33
34 Document electric continuity testing by recording the following information:

- 35 • Date of test
36 • Test methods and equipment
37 • Section tested
38 • Diameter and length of main under test
39 • Number of fittings, valves hydrants, etc.
40 • Results of test including resistance
41 • If a failed test, describe actions taken to eliminate leaks and results of re-testing
42

43
44 Submit reports documenting electric continuity testing.

45 DISINFECTION/FLUSHING

46
47 After filling the main, allow a minimum of 48 hours of time for disinfection to occur before flushing.

48
49 Flush all sections of watermain and water service. When possible, utilize hydrants or other large diameter
50 orifices to complete flushing and achieve 2.5 fps water velocity. If needed, utilize services or temporary
51 connections to complete flushing.

52
53 All watermain and services shall be flushed for a minimum of 10 minutes, or as necessary to obtain a
54 sediment-free and bacteriologically safe sample.
55
56

1 Utilize diffusers, hoses, settling basins and other devices as necessary to limit erosion and other damage to
2 the site and downstream areas.

3
4 Contractor shall be responsible for providing all necessary fitting, valves, joint restraints, hydrants and other
5 materials necessary to conduct flushing.

6
7 Submit reports documenting disinfection and flushing.

8
9 BACTERIOLOGICAL SAMPLE

10
11 Following all pressure testing and flushing, the contractor shall collect a sample from the newly installed
12 watermain or water service(s). Samples shall be submitted to the State Laboratory of Hygiene, or other
13 licensed testing laboratory for bacteriological (coliform bacteria) analysis.

14
15 The Contractor shall be responsible for all costs associated with sample collection(s) and analysis.

16
17 Document bacteriological sample collection and analysis by recording the following information:

- 18 • Date of sample collection
- 19 • Sample collection methods and equipment
- 20 • Person collecting the sample
- 21 • Location(s) sample was collected
- 22 • Results of sample analysis

23
24 If sample results indicate water is “Unsafe – Coliform Bacteria Present”, Contractor shall re-disinfect
25 watermain and water services by introducing additional chlorine into the line and re-flushing the main. This
26 process shall be repeated as necessary until a clean sample is obtained. The Contractor shall be responsible
27 for all costs associated with all efforts necessary to obtain a “Safe – Coliform Bacteria Not Present” sample.

28
29 Submit reports documenting bacteriological sample collection and analysis.

30
31 End of Section

SECTION 334000 - STORM DRAINAGE UTILITIES

PART ONE - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide for the storm drainage work required in these specifications and on the drawings. The limits of the work, including the responsible party for testing purposes, shall be clearly defined on the Drawings. Included are the following topics:

RELATED WORK

Applicable provisions of Division 1 govern work under this section.

Related work specified elsewhere:

Section 300500 – Common Work Results for All Exterior Work

Section 312316.13 – Trenching

Section 312500 – Erosion Control

REFERENCE DOCUMENTS

Wherever WisDOT or SSHSC appears in this specification it shall be construed to mean the pertinent sections of the Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction (SSHSC), current edition, and all supplemental and interim supplemental specifications, as they may pertain, except this contract shall be a lump sum contract and measurement and basis of payment methods shall not apply.

Where these specifications do not cover portions of the work to be undertaken, the Standard Specifications for Sewer and Water Construction in Wisconsin, current edition, shall govern the work.

REFERENCE STANDARDS

American Society for Testing and Materials (ASTM):

C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
C507	Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
C877	Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
D1784	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
D2564	Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
D2680	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping

1	D3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer
2		Pipe and Fittings
3		
4	D3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using
5		Flexible Elastomeric Seals
6		
7	D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings
8		Materials
9		
10	F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic
11		Pipe
12		
13	F679	Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter
14		Plastic Gravity Sewer Pipe and Fittings
15		

16 American Association of State Highway and Transportation Officials (AASHTO)

17 AASHTO M252 Corrugated Polyethylene Drainage Pipe

18 AASHTO M294 Corrugated Polyethylene Pipe, 12- to 48-in Diameter

21 SUBMITTALS

22 Provide manufacturer's product information (cut sheets), shop drawings and O&M information for storm
23 drainage materials including:

- 24 • Pipe
- 25 • Fittings
- 26 • Pre-Cast and Cast-in-Place Structures
- 27 • Outfalls
- 28 • Castings

29 Provide reports documenting all required testing and televising.

32 AS-BUILT DRAWINGS

33 Show the actual locations of storm drainage facilities and service lines and structures on drawings. Show
34 changes to proposed storm drainage facilities, alignment, or grades. Show the actual locations, sizes and
35 types of underground utilities and other features encountered during construction.

36 **PART TWO - PRODUCTS**

37 REINFORCED CONCRETE PIPE

38 Pipe and fittings shall conform to ASTM C-76 for circular pipe and ASTM C-507 for elliptical pipe. Unless
39 otherwise specified, provide Class III for circular pipe and Class HE-III for elliptical pipe.

40 Joints for reinforced concrete pipe shall be bell and spigot or tongue and groove. Joints shall be provided
41 with rubber gaskets conforming to ASTM C433. Joints for elliptical pipe shall be provided with trowelable
42 impervious bituminous joint sealer that is manufactured for sealing reinforced concrete storm drainage pipe
43 joints.

44 When required, external sealing bands shall meet the requirements of ASTM C877 (Type II), and shall be
45 Mar Mac Mac Wrap, Cretex Wrap, Sealing Systems, Infi-Shield, or approved equal.

1 PVC PIPE
2
3 Conform to ASTM D-3034 with solvent weld or elastomeric joints. Pipe shall be SDR-35, unless otherwise
4 noted. Pipe over 15 inches in diameter shall meet the requirements of ASTM F679-03. Do not mix different
5 manufacturer's products, or fittings.
6
7 PVC fittings shall be same joint type and SDR as connecting PVC storm drainage pipe.
8
9 CONNECTIONS FOR DISSIMILAR PIPE MATERIALS
10
11 Where new storm drainage pipe connects to an existing dissimilar pipe, the connection shall be made with a
12 no hub type couplings meeting the requirements of CISPI 310.
13
14 Couplings shall have neoprene gaskets with stainless steel shield, and multiple stainless steel clamps with
15 worm gear tightening device. The couplings shall be made specifically for the type and size of pipe materials
16 being connected.
17
18 Couplings shall be Fernco, Husky, Charlotte, or approved equal.
19
20 MANHOLES
21
22 General
23 Provide precast concrete manholes unless otherwise shown or required. Cast-in-place manholes may only be
24 used after receiving written approval by the Oneida Project Representative and the A/E for customized
25 manhole sizes and shapes.
26
27 Submit manufacturer's preproduction (shop) drawings for approval prior to the start of manufacturing.
28
29 Contractor shall carefully locate all pipe locations, sizes, orientation and elevation prior to ordering new
30 manholes.
31
32 Precast Manhole Sections
33
34 Precast concrete manhole sections, including bottom and top shall meet the requirements of ASTM C478.
35
36 If conditions require a larger structure than shown on drawings, contact the Oneida Project Representative
37 and the A/E.
38
39 Provide eccentric cone top sections with a minimum clear opening of 24". Flat top slabs may be used on
40 manholes greater than 6-foot inside diameter.
41
42 Manhole wall thickness shall be a minimum of 5" for 4-foot inside diameter manholes, 6" for 5-foot inside
43 diameter manholes, and 7" for 6-foot and 7-foot inside diameter manholes.
44
45 Provide pre-cast manhole base. Manhole bottom section may be pre-cast with integral base.
46
47 Joints
48 Provide manhole riser and barrel sections, cones, and flat tops, with standard pipe section tongue and groove
49 joints.
50
51 Seal joints watertight with prefabricated rubber or plastic gaskets or formed in place butyl rubber seal.
52
53 Joint sealers: Hamilton Kent, ConSeal, MultiSeal Butyl-Tite, or approved equal.
54
55 Connections
56

Openings for connections in pre-cast structures shall be knock-outs or cut-outs. Cut-outs shall not extend into the joint of the bottom manhole section. Provide a minimum of 12" of separation between the edge of adjacent cut-outs or knock-outs.

Manhole Steps

Provide steps at 16" O.C. and project approximately 6" from wall.

Manhole steps shall be located in a straight, vertical line from the top of the manhole to the bottom. If the orientation of pipe openings prohibits this, locate manhole steps over the downstream pipe opening.

Manhole steps shall be steel reinforced polypropylene with ½-inch diameter deformed reinforcing bar. Steps shall be permanently secured in the manhole wall.

Manhole steps shall be American Step Company, M.A. Industries, or approved equal.

Bench and Flowline

Provide precast or cast-in-place bench and flowline.

Unless otherwise indicated on the drawings, bench height shall be ¾ the diameter of the downstream pipe. Slope bench towards flowlines at a minimum ½" per foot. Provide light broom finish on bench.

Flowlines shall be formed with gradual, uniform sweeps directed towards the downstream pipe. Provide smooth, troweled finish for flowlines.

When cast-in-place benches and flowline are used, lay the storm sewer pipe through the manhole.

Adjusting Rings

Fiber-reinforced pre-cast concrete adjusting rings meeting the requirements of ASTM C-478. Provide rings of 2" or 4" thickness.

Precompressed butyl gasket, 3/8" x 3½" shall be used between the top of the manhole and first adjustment ring, and between all subsequent rings. Butyl material shall be E-Z Stick, or equal.

INLETS & CATCH BASINS

General

Inlets and catch basins shall be round or rectangular precast concrete unless otherwise shown or required. Cast-in-place inlets may only be used after receiving written approval by the Oneida Project Representative and the A/E for customized sizes and shapes.

Submit manufacturer's preproduction (shop) drawings for approval prior to the start of manufacturing.

Contractor shall verify pipe locations, sizes, orientation and elevation prior to ordering new inlets.

Precast Inlets & Catch Basins

Precast inlets, shall meet the requirements of ASTM C478.

If field conditions require a larger structure than shown on drawings contact the Oneida Project Representative and the A/E.

Joints

Inlets requiring separate base and riser sections must be provided with standard pipe tongue and groove joints.

Seal joints watertight with prefabricated rubber or plastic gaskets or formed in place butyl rubber seal.

Joint sealers: Kent Seal, ConSeal, MultiSeal Butyl-Tite or approved equal.

1 Pipe Connections

2
3 Provide custom knock-outs/cut-outs based on project and location specific conditions.

4
5 A minimum of 2" of the precast structure is required between the top of a knock-out/cut-out and the top of
6 the structure. A minimum of 2" of precast structure is required between the side of a knock-out/cut-out and
7 the inside face of an adjacent sidewall.
8

9 Inlet Flowline

10 Provide either pre-cast or cast-in-place flowline that provides positive flow through the structure. Provide
11 bench that directs water towards the flowline.
12

13 Flowlines and benches shall be formed with gradual, uniform sweeps directed towards the downstream pipe.
14 Provide smooth, troweled finish for flowlines.
15

16 Catch Basin Sump

17 Outlet pipe invert shall be located above the bottom of the catch basin as shown in the detail drawings. Sump
18 shall be watertight.
19

20 Adjusting Rings

21 Fiber-reinforced pre-cast concrete adjusting rings meeting the requirements of ASTM C-478. Provide rings
22 of 2" or 4" thickness.
23

24 Precompressed butyl gasket, 3/8" x 3 1/2" shall be used between the top of the inlet and first adjustment ring,
25 and between all subsequent rings. Butyl material shall be E-Z Stick, or equal.
26

27 CASTINGS

28
29 General

30 All castings shall be heavy duty iron conforming to ASTM A48, Class 20 and rated for AASHTO H-20
31 loading. Provide non-rocking or machined castings with concealed pickhole.
32

33 Standard Manhole Frame and Casting (Solid Lid)

34 Neenah Foundry R-1550, with Type B lid; or approved equal.
35

36 Low Profile Manhole Frame and Casting (Solid Lid)

37 Neenah Foundry R-1689, with Type B lid; or approved equal.
38

39 Standard Manhole Frame and Casting (Open Grate)

40 Neenah Foundry R-2050, with Type D grate; or approved equal.
41

42 Low Profile Manhole/Round Catch Basin Frame and Casting (Open Grate)

43 Neenah Foundry R-2464, with Type D grate; or approved equal.
44

45 Standard Security Manhole Frame and Casting (Solid Lid)

46 Neenah Foundry Company R-1916-C with bolt down type B lid; or approved equal.
47

48 Standard Security Manhole/Round Catch Basin Frame and Casting (Open Grate)

49 Neenah Foundry Company R-2050 with Type D grate having 4 Type "E" countersunk flathead pent socket
50 screws; or approved equal.
51

52 Low Profile Security Manhole Frame and Casting (Solid Lid)

53 Neenah Foundry R-1689, with Type B lid having 4 Type "E" countersunk flathead pent socket screws; or
54 approved equal.
55

56 Low Profile Security Manhole/Catch Basin Frame and Casting (Open Grate)

57 Neenah Foundry R-2464, with Type D grate having 4 Type "E" countersunk flathead pent socket screws; or
58 approved equal.

Standard Curb Inlet Casting

Neenah Foundry Company R-3067, with Type A grate; or approved equal.

Gutter Inlet Casting

Neenah Foundry Company R-3290-A; or approved equal.

Flat Inlet Casting

Neenah Foundry Company R-1878-B7G; or approved equal.

LOCATOR TAPE

Detectable metallic locator tape, specifically manufactured for marking utilities.

Tape shall be a minimum of 6" wide and shall be marked "STORM".

PART THREE - EXECUTION

GENERAL

Complete exploratory excavations at utility crossings as shown on the drawings and as necessary to complete the work.

Maintain clearances between existing or proposed storm drainage lines and watermain as follows:

- 8' horizontal separation (measured center to center) between existing or proposed sanitary or storm drainage lines and watermain.
- 12" vertical separation (measured from outsides of pipes) where watermain cross over sanitary or storm drainage lines.
- 18" vertical separation (measured from outsides of pipes) where watermain cross under sanitary or storm drainage lines.

Notify the A/E and Oneida Project Representative of utility conflicts as soon as they are encountered.

Store and handle pipe in accordance with manufacturers' recommendations. Keep pipes clean of soil, debris and animals.

LAYING PIPE

Install pipe in accordance with the SSSWC and ASTM specifications that pertain to the specified type of pipe material and the installation situation.

Do not use any pipe or fittings cracked in cutting or handling or otherwise not free from defects.

Clean all pipe of any dirt and/or debris both inside and outside prior to placing in the trench.

Make joints in accordance with manufacturer's directions with due care to avoid damaging pipe and/or disturbing previously laid pipe.

Cut pipe only according to manufacturer's directions.

Lay all drainage pipes to horizontal alignment and grade shown on the drawings with bell ends up hill.

Establish and maintain horizontal alignment using total station, transit or theodolite. Discrepancies from the required horizontal alignment or grade at any location shall not be greater than 0.10' or 0.05', respectively.

BEDDING/UTILITY COVER

Provide bedding and utility cover in accordance with the applicable requirements of Section 312316.13 – Trenching.

Where excavation extends below the bottom of the structure's base or the trench, bring the excavation to the required elevation by the use of compacted Crushed Stone Bedding.

A minimum of 12" of compacted Crushed Stone Bedding shall be placed below the structure base.

A minimum of 6" of compacted Crushed Stone Bedding shall be placed below the storm drainage pipe and 12" of cover material shall be placed over the storm drainage pipe (both measured at the bell of the pipe).

STRUCTURES (MANHOLES, INLETS, CATCH BASINS)

Structures having improper location and/or orientation of the pipe connections will be rejected. Field repairs or adjustments of connection points are not permitted.

Do not connect abandoned pipes to new structures.

Limit the excavation for structures so as to provide only the necessary amount of space to sufficiently prepare the subgrade, set the base, set the structure, and lay pipe. Provide adequate clearance for compaction equipment and operator between structure and trench soil retention for adequate backfilling and compaction.

Set structure base in accordance with elevation and location as indicated on the drawings. Install base plumb and level. Install subsequent pre-cast sections in accordance with shop drawing layout. Provide watertight gaskets between each section.

Inlets and Manholes

Pour inverts with smooth surface draining to downstream pipe. Where two or more lines meet at an angle, provide curved channel. Slope bench or floor at 2 inches/ft towards flow channel.

Catch Basins

Verify sump is clean and watertight after connecting pipes to catch basin.

Structures shall be provided with between 4" and 8" of adjusting rings, with the top adjusting ring being 2" thick. Provide butyl sealant material between rings. Once rings are in place, tuck point the exterior joint and provide the entire exterior surface of the adjusting ring riser with a coating of mortar.

CASTING INSTALLATION

Install casting type as indicated on the drawings or in the specifications.

Provide butyl sealant material between last adjusting ring and casting base. Adjust casting elevation and slope to match adjacent proposed grades.

CONNECTIONS TO EXISTING STRUCTURES

Make all necessary openings into existing structures or drainage pipes including the reconstruction of existing inverts or benches, as necessary. Patch all openings permanently watertight with concrete brick and mortar, hydraulic cement, or flexible watertight boots.

DRAINAGE LATERALS

Connect existing storm drainage laterals in accordance with all of the requirements of the storm drainage mains, including bedding, backfill, compaction, and jointing of the pipe. Connect drainage laterals to the storm drainage main by means of an approved "wye" fitting. Connect the new pipe to the existing lateral material using a no-hub coupling or approved transition fitting. Coupling/fitting shall be selected for the specific pipe material being connected.

1 LOCATOR TAPE
2
3 Install locator tape directly above new non-metallic storm sewer pipe approximately 15 inches below
4 finished grade. Bring tape to surface and terminate in a drainage structure.
5
6 DEFLECTION TESTING
7
8 Test all PVC and HDPE drainage pipe in the presence of the Oneida Project Representative by a "go-no-go"
9 deflection test mandrel furnished by the Contractor. Do not perform deflection testing any sooner than 30
10 days following the installation of the pipe. Pull the mandrel by hand, or hand operated winch so as to avoid
11 any damages to the pipe that may be caused by mechanized pulling equipment.
12
13 Size the mandrel to test the pipeline for a maximum allowable internal deflection of the pipe (in any
14 direction) of not to exceed five (5) percent of the original internal diameter for the pipelines tested, regardless
15 of how long after installation the testing takes place.
16
17 Where poor trench soils conditions require the pipe excavation to be undercut and/or over excavated, the
18 Construction Representative reserves the right to require an additional deflection test prior to the expiration
19 of the Contractor's one year performance guarantee.
20
21 Remove and replace all pipe that fails to pass the five (5) percent vertical deflection testing until the pipe
22 passes the deflection test.
23
24 LEAKAGE TESTING
25
26 Storm sewers shall be visually inspected for excessive water infiltration and soil leakage into sewers or
27 structures. Contractor shall repair/correct any infiltration or soil leakage that is considered excessive by the
28 Oneida Project Representative.
29
30 ABANDON SEWER
31
32 Where indicated on the drawings, existing sewer to be left in place shall be abandoned in accordance with
33 Section 3.2.24 of the SSSWC. Sewer shall not be abandoned until existing laterals have been reconnected to
34 the replacement sewer. Abandoning sewers is considered incidental to the construction.
35
36 End of Section